

# A Dialogue between 2 SDs: Observation Report of a Service Design Event Using Tools from System Dynamics

Wang Zhao<sup>1</sup>

\* Observation sponsored by the UK Chapter of the International System Dynamics Society

**Contents:** Interactive System Dynamics “encompasses both SD-based interventions performed in a group decision style and its use to support organisational learning” (Lane, 1999). It offers useful tools to facilitate problem articulation and group learning in workshops that focus on societal challenges. In Belfast, Northern Ireland, a Service Design workshop to explore how people can design services for an aging population from a systems level approach was held on Friday 8<sup>th</sup> November 2019.<sup>2</sup> The event mainly focused challenges faced by adult social care in Northern Ireland – the home care service provided for seniors and disabled persons – as well as the housing issue in providing these services. The idea of system thinking, the system dynamics modelling method, and tools from Interactive System Dynamics were introduced to the participants and used by them in the workshop. Based on empirical observation, the author reports on details of the event and discusses (1) the methodological innovation of integrating System Dynamics into Service Design and (2) assumptions and implications underlying such an integration from a social theory perspective.

## Adult social care: situation and challenge

Adult social care is the health care service and support provided for adults who ‘need practical support because of illness and disability’ in the UK. (NHS, 2018) The provided service varies from help with daily living at home to a sheltered housing or care home. (NHS, 2018) Although the overall cost of these services is shared between the council and service recipient, public funding takes a big part in making them happen. (Full Fact Team, 2017)

This is a nationwide affair and the situation is never simple. Between 1<sup>st</sup> April 2015 and 31<sup>st</sup> March 2016, “there were over 1.8 million new requests to local councils for adult social care”, most of which were from adults over 65 (Adult Social Care Team, 2016). On the other hand, certain kinds of service seemed to be in shortage: as estimated by Age UK, in 2017 there were nearly 1.2 million people in England “who didn’t receive the help they need with essential activities”. (Age UK, 2017, p. 29) The balance between service provision and demand is also sensitive to funding cuts. A clear fall in the number of older population in England receiving social care was observed while the “provision of local authority funded and/or arranged social care support” declined during the same period. (Age UK, 2017, p. 25)<sup>3</sup> Moreover, this service system will expectedly be more burdened, as the number of aged people rises and there become more requests for adult social care every year.

Associated with this situation are challenges to all the parties including service providers, recipients, and those who ultimately pay for the services. In the case of Northern Ireland, the challenge for service provider is at least three-fold: how many resources do we have, what kind of service do people need, and finally how to deliver the services with available resources. It doesn’t mean the system is badly

---

<sup>1</sup> PhD student on System Dynamics and Data Science, University of Strathclyde, Glasgow, UK;  
Alumnus of Erasmus Mundus European Master in System Dynamics.

Email address: [wang.zhao@strath.ac.uk](mailto:wang.zhao@strath.ac.uk)

<sup>2</sup> “About this Event”, see <https://www.eventbrite.co.uk/e/service-design-system-dynamics-modelling-workshop-tickets-76924989715#>

<sup>3</sup> See appendix for original analyses.

functioning, but improvements on the current system are needed to meet future challenges. For example, in terms of human resource management, information about the status of a social worker is currently updated to the database every three years on average, a period long enough for many changes to take place. For example, by the end of the third year, we may find that a worker had stopped working as a social worker for 2 years. We also need to consider that these challenges are interrelated: a different design of service could have an impact on how such service is delivered, which in turn affects the utilisation of available resources.

### **The workshop in a nutshell**

The workshop in Belfast focused on designing the service. The basic questions are what people in illness and disability need, how to design services to fulfil the demand, and how to deliver them. The event is held by Strategic Investment Board, a think tank-like company working closely with the public agency that oversees adult social care in Northern Ireland – the Northern Ireland Social Care Council (NISCC). NISCC has a plan to strategically improve the *status quo* in adult social care in order to meet future challenges. The author's PhD project is in conjunction with one of their strategies related to data analysis and model building, but in this service design event, his role was more about observing.

According to Wikipedia, “Service design is the activity of planning and organizing people, infrastructure, communication and material components of a service in order to improve its quality and the interaction between the service provider and its customers. [...] The purpose of service design methodologies is to establish best practices for designing services according to both the needs of customers and the competencies and capabilities of service providers.” (Wikipedia contributors, 2019) In this Belfast event, with social care service and the related labour force and housing problem being the focuses, participants working in “service delivery, service design, policy design, and in particular healthcare and housing”<sup>4</sup> are invited to work in groups to identify the challenges and discuss about possible improvements.

Because of the aforementioned interrelation between challenges, system thinking as a method is introduced to the participants to promote thinking and discussion on a systems level. For this purpose, members from the UK Chapter of the International System Dynamics Society were invited to introduce system thinking and the use of model as a tool to develop, exchange, and formalise ideas.

---

<sup>4</sup> “About this Event”, see <https://www.eventbrite.co.uk/e/service-design-system-dynamics-modelling-workshop-tickets-76924989715#>



Figure 1. Douglas McKelvie from the UK Chapter of the International System Dynamics Society giving a brief introduction to a System Dynamics model of a service - workforce - cost model. Photo by the author.

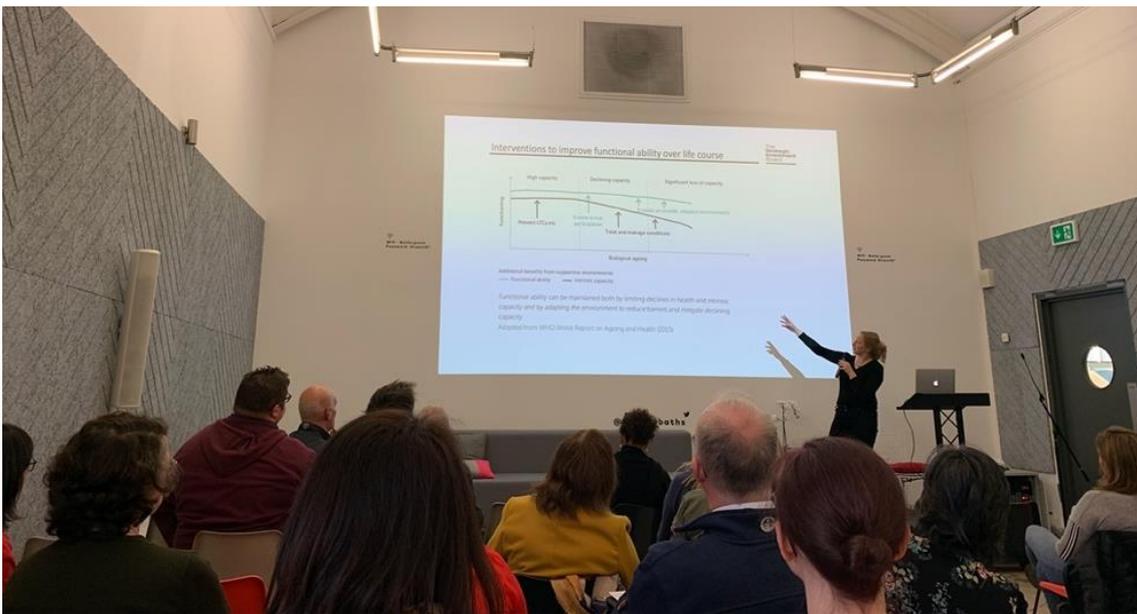


Figure 2. Sarah Megan Wylie from the Strategic Investment Board talking about the improvement in life quality by investing in adult social care. Photo by the author.

After about 20 minutes' introduction, the 2-hour workshop proceeded with the following agenda.

## 1 Group and Topic

### 1.1 Creating groups

All participants (around 40) were divided into groups, each with 6 to 8 members sitting around a table. In each group there was a member either from the System Dynamics

Society or from the Strategic Investment Board familiar with the agenda and the idea of system thinking. Stationary like sticky notes, markers, and paper sheets was provided.

## **1.2 Assigning topics and setting expectations**

Predefined topics about adult social care were randomly assigned to groups, which means there was not a selection process. The author's group got the topic 'supports for people with mental impairment'. There were other topics about people with disability, the housing issue, and so on. Before starting, the agenda for group work was explained to all participants (as below), in which every step is associated with an expected outcome. A large sheet of paper with the agenda printed on was distributed to every group as both a reminder and a framework to organise the outcomes.

## **2 Teamwork**

### **2.1 Problematic behaviour**

The group was first asked to come up with a problematic behaviour related to the assigned topic. The behaviour, which is called 'reference mode' in System Dynamics, is the change in a variable over time and sketched as a curve in a coordinate system.

### **2.2 Variable elicitation**

The group was then asked to come up with related things – or 'variables' – that have to do with the topic. In fact, the only criteria for this step was relevance. Team members were thinking individually and put everything they got onto the sheet using sticky notes.

### **2.3 Variable categorisation and simplification**

With about 30 variables on the sheet, the team started to group the variables into a few categories by relocating sticky notes. There was no pre-conception about the categorisation, so categories emerged as the process went on. Group members had discussions on issues such as whether two variables were the same, how should a set of variables be named, and so forth.

Group dynamics emerged at this step. Some discussions could go very deep if one or two members with experience related to the topic shared insights or had debates. This was the case for the author's group, where two members with rich experience in social work shared their experience with others. However, such discussions could also divert the group from proceeding with the agenda. There was therefore a balance to maintain.

### **2.4 Causal mapping**

The group was then asked to identify a few causal relationships from the variables based on members' individual understanding. This created discussions as the members could perceive the causality between variables differently. Not all variables were finally included in causal relationships. Different groups progressed with this step to different extents. For the author's group, this step was nearly untouched while a few other groups managed to create a causal structure.

### **2.5 Storytelling and visualisation**

Finally, the group was asked to tell a story about a virtual character based on the discussions they had and the causal model they developed. The story was preferred to be more vivid with details. For example, it could start with 'John Smith is 70 years old

and he lives in a community named ...' For the same purpose, the group was also asked to visualise the story by drawing a scene on the paper sheet featured by the virtual character.

### 3 Presentation

The final outcome of one group was presented and explained to all participants. Outcome varies from group to group, but the one presented included almost all the expected components – a problematic behaviour, a set of variables, a causal map, a visualised story, and even a simple stock-and-flow structure, implying the agenda was well followed. The elaboration was succinct due to limitation of time, but people managed to get the gist of the group's idea.

## Methodological discussion

Can System Dynamics and Service Design be compared? The answer depends on how we define System Dynamics. "System Dynamics is a computer-aided approach to policy analysis and design." ("What Is SD," 2019) This definition from the official website of the System Dynamics Society is seen and probably also accepted by many, but it is not inclusive. An analysis by Lane (1999) shows that System Dynamics originated in 1950s by applying servomechanism engineering to social science studies (Richardson, 1991) and had evolved over time. Developing on different directions, by the end of the 20<sup>th</sup> century, practices in the field had ranged from positivist works such as business flight simulator to interpretivist works such as Group Model Building. These practices differ in many aspects, including the source from which the model seeks confidence (Lane, 1999), the role a model plays in a practice, and so on. Overall, System Dynamics is an extensive discipline where highly diversified practices are linked by two notions: the feedback approach and the endogenous perspective (Forrester, 1961; Lane, 1999).

Service Design as an activity to optimise services has not developed into a field or a discipline. Direct comparison may not be a good approach to study its relationship with System Dynamics because to do so we need to assume both are disciplines. Considering the aforementioned definition that sees Service Design as an 'activity' (Wikipedia contributors, 2019), it is arguable that Service Design is a genre of practice with a clear purpose to optimise services through engaging actors and stakeholders, although the tools for doing this and the implementation process could vary across concrete projects. Therefore, Service Design is more comparable with a genre of practice in the System Dynamics discipline such as interactive SD or policy engineering than with System Dynamics in general.

Due to its participatory approach, Service Design may be related to interactive SD, a genre in the System Dynamics field which "encompasses both SD-based interventions performed in a group decision style and its use to support organisational learning" (Lane, 1999). One outstanding practice in interactive SD is Group Model Building, "a system dynamics model-building process in which a client group is deeply involved in the process of model construction" (Vennix, 1999). Similarities between Service Design and Group Model Building can be found in multiple aspects. Both of them are adopted to improve a situation and expect certain kinds of outcome: shared understanding of the situation and policy suggestions (for GMB) or service suggestions (for Service Design). They both employ a participatory approach to engage stakeholders. In Service Design, there are developed methods for identifying actors, defining service scenarios and actors' role and actions, and visually representing the service (Morelli, 2006). In Group Model Building, System Dynamics models are used to represent, compare, and contrast stakeholders' mental models in order to create an intersubjective understanding. Moreover, through years' practice the procedure of Group Model Building has been modularised into step-by-step 'scripts', which are easy to follow for practitioners while keeping the entire procedure customisable (Andersen and Richardson, 1997).

More important is the innovative integration of methods from Group Model Building into a Service Design workshop and the difference such a move makes. Among others, two methods imported from

Group Model Building made considerable contribution to the workshop. The first is that the workshop was organised following a GMB-like procedure. GMB sessions used to follow a divergence – convergence structure, where in the first half of the session knowledge and individual understanding are elicited from participants, based on which causal relationships are identified to formulate a theory able to explain the ‘reference mode’ – an observed problematic behaviour.

This process was adapted for the Service Design workshop and suited well in general – but not for every step. The main confusion was experienced with ‘reference mode elicitation’, for which author’s group was asked to come up with a problematic behaviour regarding the assigned topic ‘people with mental impairment’. Group members had difficulties in identifying a problematic behaviour before agreeing on using a somehow ambiguous variable ‘the amount of support a person with mental impairment can get’, which was not mentioned again in the rest of the session.

One explanation the author could come up with is that a reference mode is more necessary when the groupwork follows a problem-driven ideology, under which a manifested – at least perceived – problem is the reason for which people come and work together. In the Service Design workshop, although the problem of adult social care was clear in general – shortage of labour force, unmet demand of housing, etc., the topics derived from it were not so clearly defined, and the participants were not involved in defining those topics. That made it harder for the participants to find a problematic behaviour for certain topics, as in the case of the author’s group. On the other hand, organisational learning was also the workshop’s objective. However, for organisational learning a well-defined problem is not always needed. In organisational learning, achieving a better perception of a problem could itself be part of the learning outcome and hence needs to progressively evolve as the session goes on. Moreover, as most workshops are limited by time, participants’ familiarity with the System Dynamic Simulation method, and the hardship of building a simulation model in 2 hours, a reference mode can only give limited help to model validation through checking the simulation result against the historical data. This reminds the author that although the diverging-converging session design is useful in planning a Service Design workshop, flexibility in such a process needs to be considered for better alignment with the workshop’s goals.

The second method from System Dynamics that contributed to the workshop is the use of SD model. Morelli (2006) demonstrated different forms for representing the outcome of Service Design. Many of them can elaborate the designed service in detail and show a strong power of visual expression. System Dynamics models do not replace them but can be good compliment in two senses. First, by articulating the structures and mechanisms underlying the observed phenomenon, an SD model provides a causal account (a theory in a story-like form) which is both the starting point for and the context of a policy or service. It adds to the designed service’s credibility by showing its interaction with a broader system whose situation is to be improved. Second, System Dynamics models are capable of representing mental models (Forrester, 1994), a feature that makes SD models suitable carriers of individual knowledge and shared understandings. They could be used in Service Design workshops not only to represent the outcome, but also as tools to help with the expression, comparison, and integration of individual understandings in an easy-to-understand way.

On the other hand, the story-telling method used in the workshop for demonstrating a service with a vivid description of how it is used by a virtual person may inspire further development in methods for Group Model Building. Telling a story is more than to create another version of description with articulated details, because the story-telling process also helps people to test a hypothesised service against day-to-day experience in an ethnographical way – putting oneself into the service recipient’s shoes and experience the service as if she/he was the recipient. This is exceptionally helpful since in Service Design the designed services are directly offered to individual recipients to help with their daily life. In Group Model Building practices, projects often end with policy suggestions. When the policy has to do with multiple individuals, a story-telling test could offer additional opportunities to refine the policy suggestions and increase their credibility.

## **Philosophical reflection**

Lane (1999) advised practitioners to explicate “the social theory of established practice” that uses System Dynamics and consciously “choose their social theoretic stance” to avoid getting ambiguous in or ignoring philosophical “assumptions and implications” of their practice. He used a framework proposed by Burrell and Morgan (1979) to analyse and position different SD practices up to his date. “The framework classifies social theories and related System Dynamics practices using a two-axis coordinate system. The first axis *subjectivism – objectivism* denotes how a theory sees the nature of social science, asking ‘do you believe the existence of the social reality’ while the second axis *regulation – radical change* denotes how a theory sees the nature of society, asking ‘is the society to be explained or to be transcended to emancipate human’” (Zhao, 2020)

As discussed before, a Service Design workshop using methods from System Dynamics could arguably be categorised as a practice in the genre of interactive system dynamics. According to Lane (1999) the early ideas of Group Model Building (Vennix, 1990) is also located in this genre. “‘Interactive SD’ encompasses both SD-based interventions performed in a Group Decision Support style and its use to support organisational learning” and emphasises the provision of tools to help people precisely articulate their opinion, form interpersonal understanding, and ‘decide on a course of action’ to take (Lane, 1999). The two objectives implicitly embedded in the Service Design workshop – designing services and learning as a group – make it well fitted to the genre of interactive SD. Interactive SD takes interactionism and social action theory as underlying social theories (Lane, 1999). These theories believe that patterns of social rules and the society are determined by more fundamental structures – in our case, the patterns and rules refer to how aging population are supported, and the fundamental structures refer to the society’s mechanisms underlying the adult social care sector. Through interpretation of individual’s actions, it is possible to discover these patterns and rules and understand the more fundamental structures, based on which people may also change the patterns and rules – because they have to do with aging population’s well-being – by affecting the underlying mechanisms and structures through individuals’ action. In our case, the actions will be the designed services together with other policy changes to be made in adult social care. Under the aforementioned Burrell and Morgan (1979)’s framework, a Service Design practice as in the observed event would appear in the middle of each axis. On the *regulation – radical change* axis, a combined goal of organisational learning and policy improvement places the practice halfway between the two ends – regulative explaining of the *status quo* (Lane, 1999) and making change to the social reality. On the *subjectivism – objectivism* axis, with System Dynamics model being used, the balanced reliance on two sources for model credibility – empirical observation of the adult social care sector and interpretive construction of a shared theory concerning the sector’s underlying mechanism – places the practice halfway between the two ends, ‘subjectivity’ and ‘objectivity’.

## Acknowledgement

The author thanks Sarah Megan Wylie, Douglas McKelvie, Donald Scott, and Conor Meehan for the insightful discussions in Belfast.

## References

- Adult Social Care Team, 2016. Community Care Statistics Social Services Activity, England, 2015-16. NHS Digital.
- Age UK, 2017. The Health and Care of Older People in England 2017.pdf [WWW Document]. URL [https://www.ageuk.org.uk/Documents/EN-GB/For-professionals/Research/The\\_Health\\_and\\_Care\\_of\\_Older\\_People\\_in\\_England\\_2017.pdf?dtrk=true#page=29](https://www.ageuk.org.uk/Documents/EN-GB/For-professionals/Research/The_Health_and_Care_of_Older_People_in_England_2017.pdf?dtrk=true#page=29) (accessed 2.9.20).
- Andersen, D.F., Richardson, G.P., 1997. Scripts for group model building. *System Dynamics Review: The Journal of the System Dynamics Society* 13, 107–129.

- Burrell, G., Morgan, G., 1979. Sociological paradigms and organisational analysis elements of the sociology of corporate life. Heinemann Educational, London.
- Forrester, J.W., 1994. System dynamics, systems thinking, and soft OR. *System dynamics review* 10, 245–256.
- Forrester, J.W., 1961. *Industrial dynamics*. Cambridge, Mass. M.I.T. Press and Wiley, Cambridge, Mass.
- Full Fact Team, 2017. Adult social care in England [WWW Document]. Full Fact. URL <https://fullfact.org/health/adult-social-care-england/> (accessed 2.9.20).
- Lane, D.C., 1999. Social theory and system dynamics practice. *European Journal of Operational Research* 113, 501–527.
- Morelli, N., 2006. Developing new product service systems (PSS): methodologies and operational tools. *Journal of cleaner production* 14, 1495–1501.
- NHS, 2018. Introduction to care and support [WWW Document]. nhs.uk. URL <https://www.nhs.uk/conditions/social-care-and-support-guide/introduction-to-care-and-support/> (accessed 2.9.20).
- Richardson, G.P., 1991. *Feedback thought in social science and systems theory*. University of Pennsylvania.
- Vennix, J.A., 1999. Group model-building: tackling messy problems. *System Dynamics Review: The Journal of the System Dynamics Society* 15, 379–401.
- Vennix, J.A., 1990. *Mental models and computer models: Design and evaluation of a computer-based learning environment for policy-making*. Radboud University Nijmegen.
- What Is SD [WWW Document], 2019. . System Dynamics Society. URL <https://www.systemdynamics.org/what-is-sd> (accessed 2.6.20).
- Wikipedia contributors, 2019. *Service design* — Wikipedia, The Free Encyclopedia.
- Zhao, W., 2020. *Essay on the Philosophical Stance of Combining System Dynamics with Data Science*.

## **Appendix:**

### **Original analyses for footnote num. 3**

- NHS Digital (2007), “Community care statistics, social services activity, England – 2005-06, final release,” available at: <http://www.hscic.gov.uk/catalogue/PUB01561/comm-care-ref-eng-06-ass-e-pack-tab.xls> .
- NHS Digital (2014); “Community care statistics, social services activity, England – 2013-14, final release,” available at: <http://www.hscic.gov.uk/catalogue/PUB16133/comm-care-stat-act-eng-2013-14-fin-anxe.xls> .
- Office for National Statistics (2016); “Population Estimates Total Persons for England and Wales and Regions, Mid-1971 to Mid-2012,” resource no longer available.
- Office for National Statistics (2016); “Population estimates for UK, England and Wales, Scotland and Northern Ireland,” available at: <https://www.ons.gov.uk/file?uri=/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandnwalesscotlandandnorthernireland/mid2013/ukmye2013.zip>.