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Managing Design Uncertainty: Building an Asynchronous Online Simulation

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Abstract

Simulation and negotiation game design typically works from matching learning objectives to specific settings for delivery. Understanding how variables like student numbers, prior knowledge and available time and space for game play will look like is vital for producing efficient active learning environments. Simulations are necessarily designed with a particular participant group in mind, which in turn shapes the purpose of the exercise: usually this group and setting are well-defined. This paper demonstrates the challenges that are posed when that definition is lacking by presenting the process of creating an exercise for a distance-teaching programme, where no synchronous interactions are possible, student numbers are likely to be highly variable and prior knowledge cannot be effectively gauged. Strategies for addressing each of these elements are discussed, grounded in a central focus on resilient design that can tolerate a wide range of circumstances while still delivering appropriate opportunities for learning. It highlights the need to design around a structure that can cope with such uncertainty and (relative) novelty, and the potential that is contained in such an approach for more conventional settings. In so doing, it reaffirms the need to have a conscious and transparent design and implementation process in delivering simulation and negotiation games that maximise student learning.

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Introduction

The process of simulation game design is highly contextual. Designers typically create site-specific activities that fit the particular needs of their participants and the constraints of their institutional situation. Even those building more generic exercises for use by others normally indicate the parameters for operation and adaption that they consider will allow gameplay to proceed as nominally intended. When designers share their work, in journal articles or conferences, it is often from that context and baseline parameters that they start: it situates their work, both for themselves and for their audience.

In most cases, such an approach works well. Designers usually have a high degree of confidence in the time and space available (the slot in the timetable, the room they will use) as well as in the type of participants they will have (e.g. final years on political science pathways with defined prior modules that contain particular content and skills development) and in the number of those participants (especially if they use upper and lower limits on activity/course registration). But such confidence is not always possible; it is to those situations that this paper speaks, offering a set of strategies to cope with uncertainty.

The work is grounded in the author's (ongoing) experience of designing and delivering an asynchronous online simulation for a module of a new distance-learning Master's programme in International Relations. As a new programme, student numbers are expected to vary considerable over time, even as the institutional model of distance learning requires materials to be used over repeated cycles, typically without direct intervention from the simulation designer. Moreover, the institution's commitment to wide access for students means that prior knowledge and experience is expected to be highly variable. Finally, there is also an institutional requirement to ensure that accessibility for students is very high, so the simulation must be capable of being delivered (in modified form) without either access to computing or to other students.[1] All of which makes for a much more problematic field on which to build a simulation.

The paper argues that the insights from this process are also of value for other simulation designers working in less uncertain situations, since it foregrounds practices that are resilient and durable, maximising the potential for student learning. It develops the response and the underlying strategies in a number of steps. Firstly, it reviews the core considerations around simulations and simulation

[1] In the institutional jargon, Students in Secure Environments (primarily but not exclusively prisoners).

design, before mapping out the theoretical options that are available, as typified by some ideal types of designs. Finally, it describes the chosen approach and discusses the application more generally.

Designing simulations

We do not need to rehearse here the value of using simulations in learning environments, partly because everyone has their own perspective on this and partly because it is not the primary concern here. In the specific case of this paper, a decision had been made that a simulation exercise would be included in teaching materials as the only viable means of achieving a number of learning objectives. Firstly, a simulation would allow students to understand better how negotiation works, given the hands-on experience they would gain. Secondly, it would also allow for an application of other learning on game theory, to see when and where that helps in practical situations. Thirdly, having direct experience of a simulation would be of help in generating reflection by students on the use of simulations as a research method (possibly for their dissertation later in the programme). Finally, coming relatively early in the module would allow for some community building among the students, who do not have any face-to-face elements and only limited interaction with their small tutor group. In this, the simulation conforms to the usually set of objectives that we link to their use in other contexts: substantive knowledge development, skills development and socialisation into a learning community (Usherwood 2015, Asal *et al* 2015).

Less discussed is the question of what might constitute the core considerations when designing simulations (a major exception in Asal & Blake 2006. Also Glasgow 2014, Wheeler 2006, Lantis 1998). At its most generic level, a simulation is like any pedagogic environment in that it needs to have learning objectives that are clear to all involved in it, which in turn align with the game play of the simulation itself and any assessment (Biggs 1996, Raymond & Usherwood 2013). However, the active learning nature of simulations also requires there to be a meaningful debriefing and feedback process, to ensure that participants' individual experience is connected back into the rest of the teaching that is provided. The absence of any one of clear learning objectives, alignment or debrief is likely to result in a much-reduced capacity to generate effective learning by participants (Usherwood 2014; see also Usherwood 2023a for more practical guides to design).

The active learning aspect is central in all of this, since a simulation is precisely about giving agency to the participants and inviting them to discover what they can do with that agency. Simulations provide a controlled and safe environment in which participants can act and reflect upon their agency, a process that carries value into not only the rest of their learning but also more widely in their lives.

We might represent this as exposing the distinction between that which you control and that which you don't and how these interact: the simulated environment provides a limited set of actions and activities from which the participant is free to choose, but in a dynamic interplay with other participants, whose choices have effects. It is in both the constrained environment and in the lived experience that personal reflection and understanding is created, to then be drawn out by debriefing and discussion.

These points hold for any simulation exercise, but are useful to reiterate here because they provide a fixed set of reference points for which to design a simulation operating in an unusual environment, such as the present case. As a practical example of this, the author presented the theory to the rest of the module production team (all modules being collective endeavours), to help them understand the benchmarks to which the simulation would need to be judged and from which the logics for all subsequent design decisions would proceed. The insights that others on the team could provide from their much more extensive experience in the institution's distance learning model proved invaluable in allowing for a collective discussion and decision about the most productive way to reconcile the simulation design principles and the institutional constraints.

Those constraints should be unpacked a bit further here, since they have material consequences for what follows. The university was founded with a specific mission to offer higher education to non-traditional students via distance learning. While that model originally included some face-to-face elements with residential weeks, those were dropped from the department's provision at the turn of the millennium, with a virtual learning environment being the primary delivery route. As noted, the university also provides education to many students in secure environments, some of whom are not allowed access to the internet or even computers, so the extensive production process for all teaching materials includes creating paper-based versions of everything. Module production teams typically take three years to move from conception to first delivery to students, with repeated rounds of course material (text, audio, video, interactive online, etc.) being peer-reviewed within the team and then extensively edited and produced to ensure high levels of accessibility. Individual staff typically take a lead on a four week block, which covers a major theme or question within the module, and create a mix of passive and active materials for students to work through. Students will do this in their own time at the relevant slot (working on weekly cycles) in the module delivery, which occurs twice a year: materials are intended as much as possible to be durable, with a baseline expectation that they will be used for roughly eight years, with a mid-term review. Since nothing is used by students close to the time that material is finalised by academic staff, there is a necessity to avoid highly topical content within the materials, instead (usually) asking students to consider how their learning applies to

whatever might be happening at the time they consume it. Students also have support in their learning from a group of associate lecturers, who run tutorials and undertake assessment, but who have mostly not been involved in the production phase of the module's creation (both student and associate representatives are part of the module production phase).

The module forms half of a new Masters' programme in International Relations, to start in September 2023. Target recruitment is 80 students within three years, but all materials need to be useable with fewer people and there is no bar on over-recruitment either. As an indicator, first year undergraduate modules in the department run with over 400 students. Within modules, students are allocated to tutor groups of no more than 18 people, with a dedicated associate lecturer to support their individual learner and to mark assessments: the central academic team provide coordination and address any substantive queries about materials, but do not normally engage with individual students.

In the present case, the simulation was intended to be part of a block relating to global challenges and collective action. Other content included negotiation, game theory, liberalism and green IR theory, with two primary case studies of global health cooperation and tackling anthropogenic climate change being used to illustrate and tie together elements. Typically, each week's materials include a 'textbook chapter' (authored by the module team) of approximately 8000 words, audio and video clips or interviews, small activities to test or develop understanding and a learner journal to promote reflection and integration across the module as a whole. Assessment comprises an essay and policy brief to cover this block and one other.

In theory, you can do this. Or that. Or…

Abstracted theory is all well and good, but what does this actually mean in terms of options on the ground? This was the primary question asked by the module team, by the production team that would have to ensure it could be materially delivered, and by the author. Literature in the general area remains relatively scarce (Rofe 2011 merits particular praise. Also Rofe 2015, Otto 2014, Blake & Scanlon 2007), possibly because of the obvious issues involved.

Given the particular nature of the learning environment, a number of basic options were readily apparent in creating opportunities for students to learn about negotiation (the primary learning objective). Most directly, students could engage in negotiation directly with other students. This is the classic negotiation simulation approach, both because it obviously involves actual negotiation and because in most other cases it suits the learning environment (in-person classes or events). Students

get to experience directly the key elements of a negotiation, especially the immersive elements that cannot be easily reproduced elsewhere (Usherwood 2009a).

However, the distanced and asynchronous delivery model required other options to be considered too. The next most direct option would be to remove the inter-student element of negotiation by replacing a human interlocutor with an automated one. The department had developed a simple online role-play game for another module that allowed students to pick options and deal with dynamic responses: likewise, many colleagues have made use of commercial software such as *Statecraft* to support learning (e.g. Smith & Michaelsen 2021, Kaftan & Linantud 2021, Raymond 2014). The use of such systems avoids having to synchronise students and allows for a more rigorously controlled set of choices to be explored, albeit a controlled set that lacks the human dimension of interactions or behaviour that does not necessarily conform to the expectations of rational choice theory.

As a further step back, students could focus their work on what various authors on practical negotiation describe as the most important stage, namely preparation (see Fisher *et al* 2011). If we take in a literal sense the notion that a good negotiator should enter the room knowing what is going to happen, then we might design a scenario where students do all the preparatory work (which would not require direct interaction with other students), to produce briefs and position papers, so gaining much of the insight to the process.

Finally, we could suggest a model wherein students study negotiations that they are not a part of. Most obviously, this could be a historical or contemporary example: the author made repeated use of the extended Brexit negotiations as objects for students to examine and analyse, for example (also Zartman 1974). Assuming that relevant materials (including contemporaneous media coverage) is available, such an approach allows students to get insight into a worked example with 'real-world' consequences, again without needing to engage in personal interaction at all.

Each of these four models has intrinsic value and the potential to be a useful addition to any relevant curriculum. But it is precisely that word – 'relevant' – that does a lot of work. To return to the ideas of the previous section, the learning objectives need to be clear for all involved: both the participant and the designer. If the purpose of the exercise isn't evident, then it becomes impossible to judge whether any one approach is 'better' than another. To that end, from the four basic options the author then developed a system of more applied and articulated models that would conform to the other organisational structures of the module, in order to allow the module team as a whole to have clearer sight about which might be most productive in meeting the previously established learning objectives. Table 1 summarises the key features of these models.

Table 1: Articulated models for an asynchronous distance-learning environment

Model	Key features	Synchronicity	Scale	Student interaction	Duration
1	Self-contained, 'plug and play' exercise	synchronous	Individual play or small group (6-12)	Direct interaction in group play	1 hour
2	Automated & mediated 'choose your own adventure'	Semi-synchronous	Individual, but with possible group effects	Primarily individual, with scope for large group effects	1 week
3	Negotiation preparation	Non-interactive	Individual	Individual	1 week
4	Rounds of negotiation	Asynchronous within weeks, rounds of interaction provide delayed synchronicity	Small to large group	Direct interaction	4 weeks
5	Extended rounds of negotiation	As model 3	Small to large group	Direct interaction	8 to 12 or 16 weeks

These articulated models deserve some further unpacking, since offers a worked response to the particular constraints imposed by the asynchronous distance-learning environment.

Model 1 tackles the constraints by largely side-stepping them. The exercise requires no preparation or even specialist knowledge, instead just asking students to take a short (c.30 minute) period to tackle a scenario where they have to decide what to do next. Typically this is a crisis situation, both because it stimulates engagement and because it rationalises why further information is not available (see Usherwood 2023b for an example). The self-contained nature means the exercise can be taken out of the standard virtual learning environment and be played offline with anyone available, or even as a reflection exercise, with prompts for debrief to remove the need for an external observer: the scenarios work best with between 6 and 12 players, but are also viable at numbers up to 50. As a quick, low- to no-prep experience of actual negotiating, it certainly demonstrates key principles and dynamics in an active format, but its reliance on direct and synchronous interaction limits how far it could work as a collective approach in this present module. Moreover, the optimal topics of content are at the more lurid end of political life, rather than the lower-tempo situations that describe much more of political life.

Model 2 addresses the constraints by going down the automation route. Everyone gets to play in a virtual environment, with decision points resulting in new choices to be made and effects felt. This could range from commercial software packages to a proprietary system, right down to a paper-based 'choose your own adventure' model: each would allow for much more asynchronous participation, either because students play against a computer or because you time rounds of play to fit the teaching schedule. Again, there is a relatively high level of self-contained participation and any bespoke system would permit focused depiction of theoretical insights (e.g. from rational choice). The flipside is that anything more than a very basic exercise with a couple of decision points would require both a large development team and a pile of resources if an overly mechanical simulation was to be avoided: any software would also struggle to capture new real-world information over time and so would most likely be either historic or fictional in content.

Model 3 builds on the idea that the most important part of negotiation is preparation. A contemporary scenario that gave defined roles to each student would be possible here, unlike for Models 1 and 2, allowing them to engage in detailed preparatory research and in the production of negotiating briefs (the latter would logically include content on the positions/preferences of other roles). All of this work could be done individually, without then needing direct interaction, so avoiding the synchronisation issue. In so doing, it focuses attention on a part of the negotiation process that is often underplayed, but at the price of missing out on the interactive stage, which is where the most powerful active learning effects are to be found. Thus, there are questions over whether an all-bun, no hot dog approach would maintain student engagement and/or learning.

Model 4 starts by using significantly more time than the previous models to reconcile the tensions discussed: four weeks (a standard block length) instead of an hour or a week. In process and content, this model looks a lot like a synchronous, in-person negotiation, with rounds of interaction. By making these rounds last one week, the whole process can be moved to online forums, so permitting direct negotiation in a group setting as well as space for debriefing and reflection. Of course, such a model also implies more need for active management to ensure participation (which in turn suggests that more training is also required), plus the most obvious opportunity cost that a larger simulation exercise has for other content in the block.

Model 5 looks on Model 4 and pities its lack of ambition. Instead of just running across one block, a weekly round model could run for as long as you like (the current module runs to 24 weeks, for example), since topics could easily be found that both lack simple resolution and contain potential for exploration in much deeper detail. While not as immersive as a model UN, the extended experience

of interacting with other students over a long period would provide an even richer learning opportunity than Model 4, albeit with commensurate time and management implications.

Importantly, none of these models is ideal in every regard. Instead, they represent different clusters of compromises driven by the constraints of the situation. None is a completely alien model to other settings, even if used in a rather different manner, but as an exercise in working from first principles to 'what are we actually doing to go?' they offer productive lines of development.

The delivered model

The insights from the articulated models resulted in a blended approach to developing a solution for the present case: elements from all of Models 1 to 4 were used, with Model 4 providing the main-structure. The basic structure of the 4 week, block-long simulation are found in Table 2.

Given the more involving nature of the main exercise, a Model 1 crisis game is offered in the first week. How it is played is left open to students, with bookable slots in the virtual learning environment available for synchronous play with others, downloadable formats for offline and solo play, all with debrief notes. This gives everyone an opportunity to practice both negotiation and direct interaction with other students, which is relatively rare.

The main exercise deals with some technical aspects of the United Nations Framework Convention on Climate Change (UNFCCC) relating to financial mechanisms.[2] The subject was chosen since it aligned with the key case studies of the other block material, allowed for many state roles to be used and, sadly, because it is unlikely to be resolved in the real world any time soon. The objective is to discover any possible consensus among the participating state roles, while keeping true to their preferred objectives: it is made very clear from the start that non-agreement is both possible and acceptable. Consensus is captured by voting on three questions, each of which offers a set of fixed responses relating to financing: votes are public and backed up by statements from each player.

To avoid a very large single exercise, where finding consensus would be much more obviously difficult, the main exercise runs on a tutor group size. Each tutor group (maximum of 18 people, with a single associate lecturer managing it) works as its own negotiation, with the 18 roles (each a state) being ordered for use, so any group that is smaller will still have an adequate range of state positions to

[2] UNFCCC simulations appear rather rare, despite the subject's significance: Rooney-Varga *et al* 2020, Sterman *et al* 2015;Eisenack & Reckien 2013

explore the relevant issues (arrangements are in place to ensure at least 6 students to a group since this is the minimum needed to function meaningfully). Associate lecturers randomly allocate students to roles, providing them with an information sheet that provides headline positions on anthropogenic climate change policy and links to external sources, so that they can research the contemporaneous situation (these sheets will be updated annually to account for main shifts in position).

Table 2: The structure of the simulation

Week 1		Additional course materials
Training	Model 1 exercise, to play online, offline or alone	
Main exercise preparation	Get & research role Short opening statement Voting	
Reflection	Learning journal	
Week 2		
Interaction round 1	Review opening statements Directed statement to another player Statement Voting	
Reflection	Learning journal	
Week 3		
Interaction round 2	Review statements Directed statement to another player Statement Voting	
Reflection	Learning journal	
Week 4		
Final interactions	Review statements Final statement Voting	
Reflection	Learning journal	

There are three rounds of interaction, each with voting on the questions and supporting statements. These statements are brief (either 3 minutes of audio or video or 150 words) and are intended to get students thinking both about the substantive content and the presentational aspects of the negotiation. Training resources are provided to help with those doing audio and video, which are

indicated as the preferred options: accessibility requirements mean a text alternative is also available. In weeks 2 and 3, there are directions to make directed interactions to other players and there are also instructions to make reference to theoretical insights from the other teaching elements that are proceeding in parallel to the simulation. A forum space is available for students to make as many further interactions as they like, above and beyond the specified minimums, and there is space each week for reflection in the learning journal The final week offers the students the chance to decide whether they accept the consensus that (possibly) has emerged, before offering more extended space for reflection.

The intention is to provide a relatively highly structured simulation that lets students work through the stages of negotiation, with a lot of reflection space to offset the limited capacity of associate lecturers to observe or feedback on what they have done. The model also aims to balance a contemporary subject matter with likely variable capacity to do extensive research: students should be able to extrapolate from the country sheet what a realistic response to the questions would be and to produce a short statement, even if those who can do more independent research will produce richer contributions. The tutor-group-sized approach avoids the enrolment variability issue and reinforces the developing learning community that the group will have through the rest of the module. Finally, a version of the exercise can be created that just uses the country information sheets to let a single student without online access to conduct an analysis of the likely course of the negotiation and to develop negotiating briefs.

Sounds full on, but why should I care?

This paper has presented a rather extreme and unusual situation in which to design and operate a simulation exercise: it is likely that most readers will never have to work up something similar. Which rightly prompts the question of how this might be relevant to them.

As discussed above, the present experience has reinforced the necessity of rigorous simulation design practice. However (un)familiar the situation, clarity about the learning objectives, strong alignment of those objectives to the gameplay and effective debriefing should always be foregrounded and systematically pursued. However, those core principles also have to deal with the constraints that always exist around operationalisation. These constraints include: mode of delivery; available time and space; number and type of participants, and; any necessity of assessment (Usherwood 2023a). It is only by understanding that these constraints exist that we can start to build resilient responses to them.

And it is resilience that is perhaps the key message here. Outside of a few, very particular situations, educators do not have full control over how constraints play out. In the most obvious case, student enrolments are not fixed and any short-run activity always carries the rest of an individual being ill or otherwise unavailable: how then do we build a gameplay model that can cope with the absence of any particular person or role, perhaps for a bit, perhaps for the whole thing? What if a student fails to prepare adequately for their role? Of if the technology base falls over mid-session? While part of the answer if for the designer/instructor to step in and jury-rig things, it is also incumbent on the designer to have built structures that can flex and adapt to such scenarios.

This resilience can come at three main points. Firstly, it centres on the participants themselves. Leaving roles underspecified, or mixing provided preparatory materials with instructions to do more research allows individuals to fit into the spaces by themselves, rather than having to tessellate closely. Indeed, it is arguably a key part of a simulation experience that participants discover how they have to adapt to a situation that is not quite as they had foreseen. Secondly, resilience can be incorporated into gameplay mechanisms. Different decision-making mechanisms allow for both different dynamics and scope to accommodate uncertain participation (unanimity versus consensus, for example), while active contributions might be better driven by incentives than obligations. Finally, resilience sits in the debriefing process. We should always recall that simulations are (thin) approximations to the world they seek to recreate, so inviting participants to reflect on whether and how those approximations work is always a useful exercise, even before we get to the matter of what impact an emergent problem might have had (Usherwood 2009b).

By incorporating elements of resilience throughout your simulation design, the odds of being able to run an effective actual simulation are much improved and arguably with more opportunities for student learning as well: the real world is not certain or well-defined, so your uncertain and flexibly-defined simulation can be a safe space in which to explore and reflect on that. Of course, this present simulation has yet to run, so perhaps I write too soon.

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