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An introduction to the Socially Responsible Behaviour through Embodied Thinking (SORBET) Project as a response to COVID-19

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Abstract: This paper describes an intervention piloted in secondary schools in Singapore in the second half of 2020, in response to the COVID-19 pandemic. The intervention aims to afford learners more authentic understandings of the need to invest effort and self-discipline in nurturing the new habit of practicing safe-distancing, beyond just doing so because of public exhortation. It seeks to achieve this objective through two complementary halves, the first being an activity within a virtual environment during which a (virtual) virus is diffusing, and the second being dialogue and discussion around students' decision-making and behaviours, as informed from an analysis of data of interaction from the first half, via a web-based interface. In this way, the Socially Responsible Behaviour through Embodied Thinking (SORBET) Project represents not only an intervention designed to meet the challenges to learning imposed by COVID-19, but also one of the current few which attempt to do so by leveraging students' evolving conceptions about the diffusion of a virus amongst a population. Understood thusly, the intervention has potential curricular applications in a number of disciplinary domains, such as in mathematics, geography, biology and citizenship education.

Keywords: virus diffusion, multi-disciplinary learning, embodied cognition, dialogic interaction

1. Introduction

The novel coronavirus and the disease COVID-19 has caused disruption on a global scale in 2020 from a variety of frames, including economic, sociological, infrastructural and political.
From the perspective of school-going children, they have also experienced other aspects of changes to their daily routine, in terms of (say) their parents and caregivers working from home. These experiences would have brought home the realities of life changed under COVID-19 to the students, even if they may not yet fully comprehend the nature of what viruses are and the ways in which they may spread through communities. From a sociological perspective, there have been anecdotal instances of adolescents and older students not taking recommended protocols of safe distancing sufficiently seriously (for example, National Post Canada 2020 and CNN 2020).

In the context of day-to-day interactions with others in a time of COVID-19, the fundamental problematic which the Socially Responsible Behaviour through Embodied Thinking (SORBET) environment seeks to address is the disconnect between everyday interaction (and the decision-making processes underlying it) with feedback on our action and decisions (with respect to the practice of social responsibility) which presently comes the following day through the publication of case numbers. this feedback suffers from (a) a time lag, and (b) a lack of context - the feedback is general to the population as a whole and not particular to the decisions and actions of any given individual / learner.

Further, there is currently no practical way of visually augmenting the 'safe' radius of interaction - this is especially important to younger learners, though sometimes adolescents also need timely reminders. thus, for example, some students in China wear 'one-metre-hats' (Figure 1 below), but this is not practicable on a daily basis.

Figure 1. 'One-metre hats' as augments to safe-distancing in a Chinese school.

2. Review of literature

There are currently few resources targeted specifically to help students (and the general populace) better understand the probabilistic nature of the diffusion of viruses. Some are text-based print media (for example, Smithsonian Institution, 2020), and others are web-based (for example, Washington Post, 2020). Both print-based and web-based learning resources have been designed from the paradigm of a virtual laboratory setting. As argued by Bailey, Bailenson, and Casasanto (2016), there is empirical evidence that the human mind tries to replicate and mimic grounded experiences with concrete outcomes, from knowledge gains to emotions. Gee (2003), has written about the role of what he has termed Projective Identity in game-based learning. Briefly, Gee describes how – in well-designed learning environments – a learner might potentially develop a Projective Identity as an amalgam which complements both his or her atomic (human) identity and the virtual (avatar) identity, and how such Projective Identities might persist beyond the instantiations of the game and / or the immersive environment to influence values and behaviours in other (non-game) contexts. Gee's thesis thus speaks directly towards the present critique that might be levelled against these - admittedly very early - attempts at helping make the probabilistically-driven mechanics of virus diffusion more intelligible to lay audiences. Central to Gee's thesis is an understanding of the role of embodied cognition in learning. Embodied cognition has its origins in the respective work of Vygostsky (1978) and Gibson (1979). It can be defined as the involvement of multiple senses for enriching immersion and understanding (Mahon (2015), Clark (2017)). The term refers to the idea that body and senses are not peripheral components of our thinking, instead being structuring parameters operating with respect to one's material environment, situation, and timing (Barsalou (2010); Shapiro (2011); Clark (ibid)). This stance of embodied cognition is supported by work in neuroscience. Ratey (2001), for example, has described how emotional impulses are transmitted directly to the amygdala and the insula; these – in turn – lead to actions in the motor system. In sum, mediations at both the individual and social levels involve thought, action and emotion. The three form mutually complementary facets in understanding learning. In this framing, meanings are appropriated through such mediations. Emotion is an integral part of the experience from which subsequent meaning-making is based. Understood thusly, intuitions gradually develop into scientific concepts; conversely, scientific concepts are translated to reflexive action. The construct of embodied cognition with respect to mathematics education has been elaborated in Núñez, Edwards, and Matos (1999) and has acquired an increasing popularity because of its relation with technology such as virtual reality and smart interfaces (Mahon (ibid); Amin, Jeppsson, and Haglund (2015)). For example, recent work by Miller et al (2019) has suggested that social interactions in virtual

/ augmented environments do persist in influencing human behavior even after the actual intervention has ended. The preceding discussion is summarized in Figure 2 below.

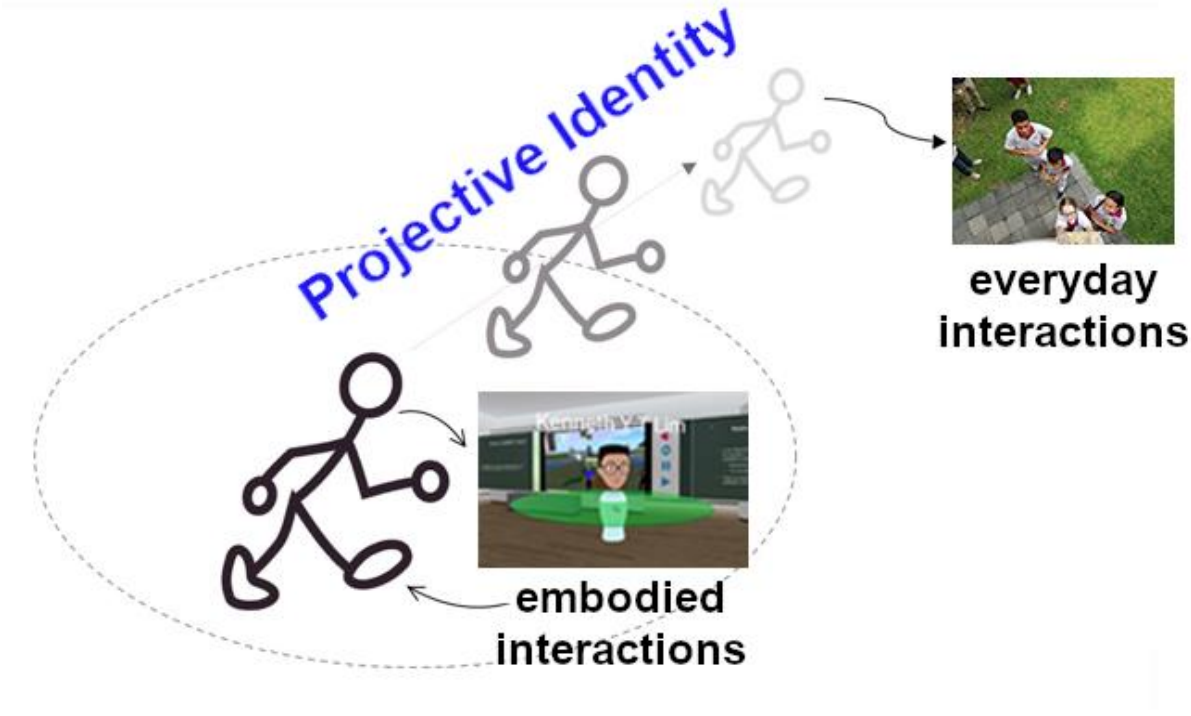

Figure 2. Theoretical stance of the SORBET approach with respect to long-term dispositional change.

It was this theoretical perspective that the team authoring the present paper conceptualised a learning environment (SORBET) in an open-source immersive world (OpenSim), in which the acronym SORBET stands for Socially Responsible Behaviour through Embodied Thinking. The environment was informed by curriculum design principles of the Six Learnings framework (Lim, 2009) in order to help learners experience, tinker with, and discuss probabilistically-driven scenarios of virus diffusion in an intelligible, embodied, manner.

3. Description of intervention

The SORBET environment comprises two complementary halves, both or either or which may be conducted in face-to-face / remote-learning / home-based learning / blended learning contexts (or, any combination thereof). For example, it has low network infrastructural requirements through an architecture known as 'Sim-on-a-Stick' (for example, students in a class may participate concurrently and collaboratively by having the environment instantiated on a portable USB thumb-drive and connecting only to a local network within the classroom (http://www.simonastick.com/)). Importantly, this same multi-player environment has also been designed such that participants need not be co-located in order to take part concurrently in an activity (such as learning during home-based confinements and similar contexts). In such a scenario, the environment would be hosted on an open-source cloud-sharing platform (or similar), with learners logging in remotely; post-activity discussion would be conducted via Microsoft Teams / Zoom, or similar. From a public health perspective, the mathematical principles undergirding modelling the geographical diffusion of disease are generally based around trying to understand the nature of how a given population transitions among three main states, namely: individuals are susceptible (S) to the virus; become infected (I); and then either recover (R) or die. The design decision was made that each student would have an equal chance of catching the virus from an

infected person because the population is perfectly and evenly mixed, and that people with the disease are all equally infectious. The SORBET approach was conceptualised and designed in April 2020 and piloted among pupils during mathematics lessons in three secondary schools in Singapore in the second half of the year, from July. The schools planned to enact the intervention in face-to-face settings as part of the formal classroom curriculum. At the time of writing (August 2020) one of the schools has enacted the activity with Grade 8 pupils (n = 105). Data from this enaction is still being analysed. Each intervention during the pilot is played through five cycles, the duration of which is customisable. Prior to the activity, teachers discuss with students the degree of infective aggression that they wish to explore, with a view to deciding upon a value for the infection condition / 'contagion sum'. During the activity, students – through their avatars – explore a virtual environment in either a free-form or semi-structured manner, depending on their learning needs. Colour-coded discs will momentarily appear around each avatar from time to time, indicating if one's personal safe radius is being infringed upon. When students' avatars come in to proximity with others, each participant interaction is recorded and assigned a random number. Should that number be equal to the contagion sum, the participant is considered 'infected'. The virtual environment in which they interact through exploration is designed to resemble a typical neighbourhood of Singapore, with a high-rise block of 'public housing', a children's playground, and other simple landscaping elements. Should teachers feel that students might need an incentive to explore it – and thus interact with each other – simple game-link activities might be incorporated such as encouraging students to scavenge the environment for hidden tokens (in such a case, these tokens would have no direct bearing on the outcome of the diffusion of the virus and are simply emplaced in the environment should teachers feel students need encouragement to explore). At the end of each cycle, the system records the state of the activity, namely: the newly infected avatars, and the total number of infected. The end of the activity within the immersive environment marks the transition from the first – embodied – half of the SORBET approach to the second half. For this second – dialogic – half, the teacher and the learners have the opportunity to access and examine the (simulated) 'infection data' through a web-based dashboard, designed in accordance with worksheets put together by teachers in a Networked Learning Community at the Academy of Singapore Teachers.

Teachers may facilitate the interpretation of the interaction data and encourage students to 'unpack' and discuss their observations and emerging hypotheses, in either face-to-face or online settings. In this way, the concerns raised in the Introduction of this paper are addressed, and participants are able to receive immediate feedback on their decision-making behind their actions, in a way which is not yet practicable in 'real world' settings. Over the long run, SORBET seeks to nurture the disposition of learners taking responsibility for their actions, in the social context of an epidemic / pandemic. Human agency therefore lies at the heart of the SORBET Project. With its emphasis on learner agency and ownership of their behaviours, learning in SORBET is active and embodied. This is congruent with the argument advanced by Bailey, Bailenson and Casasanto (2016) that there is empirical evidence that the human mind tries to replicate and mimic grounded experiences with concrete outcomes, from knowledge gains to emotions. The preceding discussion is summarized in Figure 3 below.

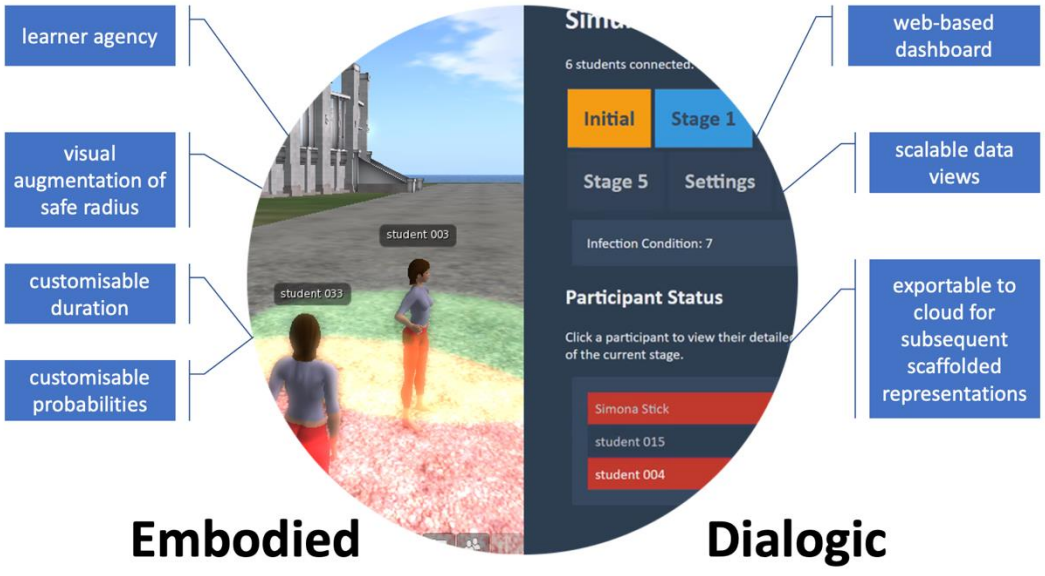

Figure 3. The SORBET system as two complementary halves.

4. Concluding remarks

This paper has described work-in-progress with respect to the design and enaction of an open-source immersive environment with a view to its use in mathematics education, with particular emphasis on helping learners have a more embodied understanding of the probabilistically-driven mechanics of virus diffusion, in contexts of learning in which the learners are not necessarily co-present. While its original use was in the disciplinary domain of mathematics, the SORBET Project would also support curricular links to other subjects such as geography (spatial diffusion), biology (epidemiology of disease) and citizenship education (positive social values). Such applications can be actively explored in future. At the time of writing (August 2020), data (such as how students respond to the intervention) from the piloting is still being collated and cannot be reported in this paper at the present juncture. Some data may be shared during the workshop within which this paper situates itself. The environment itself is designed to be scalable and designed to be easy to implement with low network infrastructure requirements. In this, it is hoped that – from the theoretical lens of Gee's (2003) Projective Identity – learners in a variety of contexts of learning (be they face-to-face, or remote learning online) will not only come away with an authentic appreciation of probabilistically-driven virus diffusion, but also with an affective appreciation of the need to practice safe distancing during the Covid-19 pandemic. In this way, it is our hope that our work contributes to the theme of the workshop within which this paper situates itself, namely of the potential role of computer-supported collaborative learning in "rethinking social interaction" during and beyond the COVID-19 pandemic.

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