

GAMEFUL LEARNING DESIGN TO FOSTER CO-CREATIVITY?

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Abstract

The effective design process of gameful systems remains a challenge for academic researchers and industry professionals tasked with collaborating to create a ‘playful’ learning system for both formal and informal educational settings. This paper reports on a gameful learning design that encourages students and teachers to be immersed in and engage ‘playfully’ with co-creative, non-linear activities triggered through embedded challenges, quests and dilemmas within a digital gaming and social networking environment. We introduce C²Learn and the project’s conceptual co-creativity framework that aims to foster co-creativity through Creative Emotional Reasoning (CER) to generate gameplayers’ Wise, Humanising Creativity (WHC). We present the goals of our gameful learning design to provide greater pedagogical insight into what types of activities and gameplay need to occur to help deepen children and young people’s relationships with real-life contexts through action and play. Then we present what our gameful learning design looks like in practice, utilising the affordances of currently available examples of the project’s game prototypes and digital tools. We argue a gameful learning design is needed first, rather than adding a ‘game layer’ to a system if the goal is to design a digitised learning system where users freely explore ideas, concepts and shared knowledge and engage in creative problem-finding and problem-solving—individually, collaboratively and communally—assisted by the system’s artificial intelligence (AI). Furthermore, this exemplifies how game affordances including feedback, agency, emotion, relevant challenges and user-centricity, over gamified elements such as points, levels, and rewards or badges drawn upon in a non-game framework, are better suited to motivate children and young people and increase their intrinsic motivation and capacity for active learning.

Keywords: Co-creativity, C2Learn, gameful learning design, gameful design, gameful system

Introduction

The effective design process of gameful systems remains a challenge for academic researchers and industry professionals tasked with collaborating to create a ‘playful’ learning system for both formal and informal educational settings. Presently, posed with such a task, we have collaborated to author a gameful learning design for industry game designers we are working in collaboration with, to guide their design of a gameful system for a digital gaming and social networking environment or ‘Co-creativity space’. The overarching goal of our gameful learning design is to draw on the playful nature of digital games to provide students and teachers with opportunities to be deeply immersed and engaged in activities that foster co-creativity. This gameful design approach stands in opposition to the more prevalent trend of ‘gamification’ that is non systemic, meaning it adds game elements or layers onto already existing environments (Deterding, 2012, 2013; Deterding, et al., 2013; Hunickle, LeBlanc and Zubeck, 2004); reward-oriented or increasing motivation through extrinsic rewards

(Deterding, 2012, 2013; Nicholson, 2012); not user-centric or not relevant to student and teacher goals (Benson, 2011; Detering, 2012, 2013; Nicholson, 2011); and pattern-bound meaning it is severely limited by narrow feedback in the form of “interface design patterns (points, badges, leaderboards) rather than affording the structural qualities of games that give rise to gameful experiences” (Deterding, 2013, p. 1). Our gameful learning design provides the pedagogical imperative to foster a particular kind of creativity which in our project—C²learn—we refer to as ‘co-creativity’. Co-creativity is novelty which has emerged through shared ideas and actions and which involves participants taking into account the impact of that novelty (Craft, Chappell and Walsh, 2013; Chappell, Walsh and Craft, 2013)

This paper first describes the C²learn project and our conceptual co-creativity framework that aims to foster co-creativity through Creative Emotional Reasoning (CER) (Scaltsas and Alexopoulos, 2013) to foster Wise Humanising Creativity (WHC) (Chappell et al., 2012; Chappell, Craft and Walsh, 2014; Craft, 2008, 2013). We then outline our proposals for ‘how’ this gameful design has the potential to encourage students and teachers to be immersed in and engage ‘playfully’ with co-creative, non-linear activities triggered through embedded challenges, quest and dilemmas within a digital gaming and social networking environment if it is attentively considered in the design process of the project’s game system by our project partners who are game designers. We do this by presenting what our gameful learning design looks like in practice, utilising the affordances of currently available examples of the project’s game prototypes and digital tools. Finally, we argue why a gameful learning design is needed first, rather than adding a ‘game layer’ to a system if the goal is to design a digitised learning system where users freely explore ideas, concepts and shared knowledge and engage in creative problem-finding and problem-solving—individually, collaboratively and communally—assisted by the system’s artificial intelligence (AI). We believe this approach best exemplifies how game affordances including feedback, agency, emotion, relevant challenges and user-centricity, over gamified elements such as points, levels, and rewards or badges drawn upon in a non-game framework, are better suited to motivate children and young people by increasing their intrinsic motivation and capacity for active learning.

C²Learn

Creative Emotional Reasoning Computational Tools Fostering Co-Creativity in Learning Processes (C²Learn¹) is a three-year research project supported by the European Commission through the Seventh Framework Programme (FP7), in the theme of Information and Communications Technologies (ICT) and particularly in the area of Technology-Enhanced Learning (TEL). The project commenced in 2012 with the aim of shedding new light on, and proposing and testing concrete ways in which current understandings of creativity in education and creative thinking, on the one hand, and technology-enhanced learning tools and digital games, on the other, can be productively combined to provide young learners and their teachers with innovative opportunities for creative learning. The project is designing a digital learning environment with game elements which includes an innovative ‘Co-creativity space’ (C²Space) incorporating diverse computational tools, the use of which can foster co-creativity in learning processes (Figure 1). The C²Learn digital gaming and social environment is envisioned as an open-world (non-linear) virtual space enabling learners to freely explore ideas, concepts, and the shared knowledge available on the semantic web and the communities that they are part of. This innovation is co-designed, implemented and tested in systematic interaction and exchange with stakeholders following participatory design and participative evaluation principles. This happens in and around school communities covering a learner age spectrum from 10 to 18+ years.

¹ *The C²Learn project has been supported by the European Commission through the Seventh Framework Programme (FP7), under grant agreement no 318480 (November 2012 – October 2015). The contents of this document do not represent the views of the European Commission and the Commission cannot be held responsible for any use which may be made of the information contained therein. Responsibility for the information and views set out in this document lies entirely with the authors. © C²Learn Consortium, 2013. Reproduction is authorised provided the source is acknowledged.*

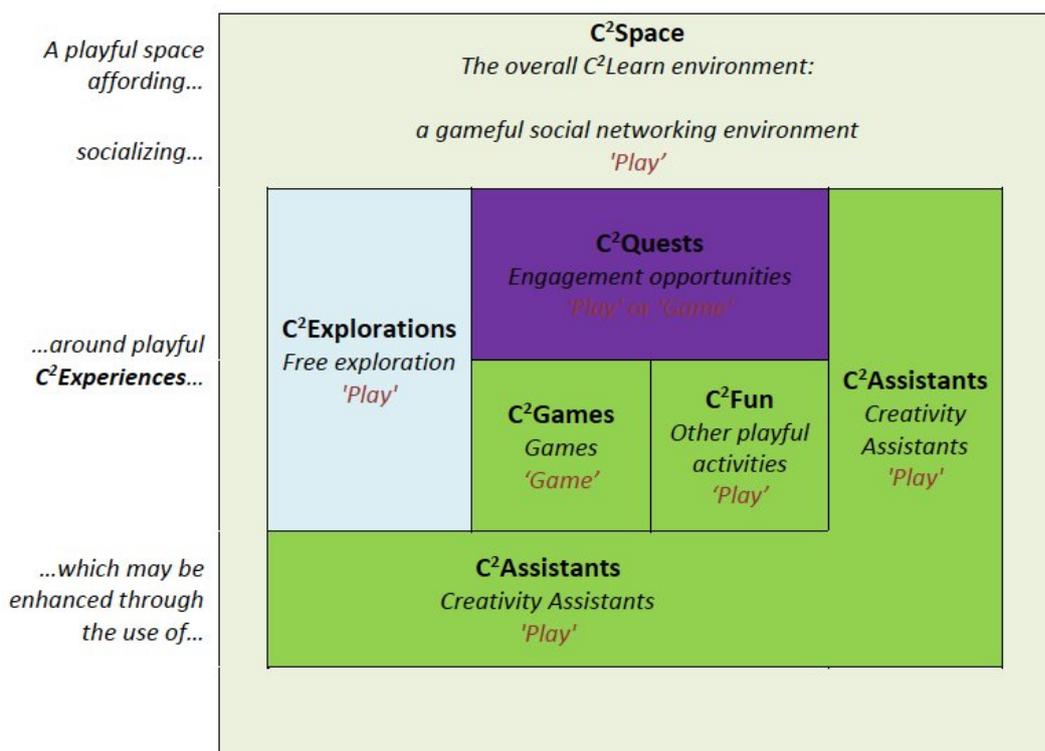


Figure 1: How the gameful design of C2Space fits together

C²Learn co-creativity conceptual framework

The goal of C²Learn is to foster co-creativity through Creative Emotional Reasoning (CER) to generate students and teachers’ Wise, Humanising Creativity (WHC). As explained further below, CER is essentially a way of using disruption and re-framing to foster co-creativity. WHC attends to the impact of co-creative activity in relation to the maker/s and others. The intention is that the tools and strategies of CER are harnessed to generate WHC activity between participants in the C²Space through its elements of game design and social networking. The Open University (UK) and the University of Edinburgh conceptualised how WHC and CER might best be theoretically inter-related in order to represent conceptually what the C²Learn experience will enable students and teachers to do in terms of fostering their co-creativity. The clearest way to illustrate this was through a diagrammatic representation illustrated in Figure 2 below. This is followed by an explanatory text that defines C²Learn’s use of the term ‘co-creativity’. It also provides a clear explanation of the ‘what’ of co-creativity defined in terms of the interrelationship between WHC and CER which emerges at the centre of the figure below.

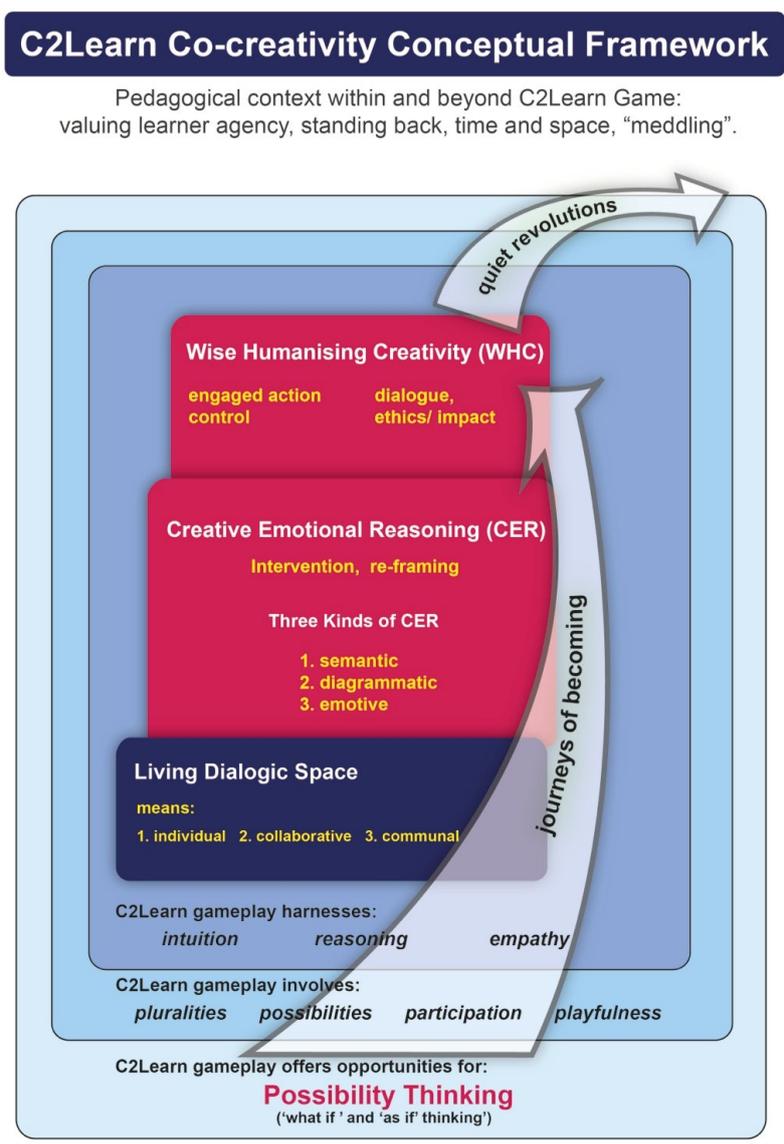
C²Learn co-creativity

C²Learn creativity is co-creativity. This is the most important concept that underpins the C²Learn digital game and social networking environment. This creativity is not only an individual activity, but also happens in collaboration with fellow users, both inside and outside the digital learning system. Additionally these individual and collaborative creative activities form part of a wider web of communal interaction. In the project this interaction of individual, collaborative and communal creativity (Chappell, 2006, 2008) is referred to as ‘co-creativity’.

One of the drivers for C²Learn’s co-creativity is for students and teachers to be asking ‘what if’ and ‘as if’ questions:

- what if I choose to explore this part of the game over another...?;
- what if I use this tool to help me solve a challenge...?
- how can I imagine this as if I were...?;
- what happens if I collaborate with that player as if I...?.

Together this ability to ask ‘what if’ and ‘as if’ questions is called ‘possibility thinking’ (Author, 2010, 2013). This is strongly encouraged in the way the C²Learn digital gaming and social environment and tasks are being designed in order to help teachers and students imagine new ideas; to shift from ‘what is’ to new possibilities of ‘what might be’.



Pedagogic strategies are built into the game and alongside it (in classroom) to enable WHC through LTC².

Figure 2: C²Learn Co-creativity Conceptual Framework

Within C²Learn’s C²Space and their classrooms, students and teachers are encouraged to open up a ‘problem space’ or a ‘challenge space’ informed by the perspective(s) of their community, or beyond. It then offers the opportunity for playtesting or collaborating to address the problem in fun, non-confusing and engaging ways. The C²Space involves engagement and co-operation where students and teachers articulate their goals to solve the problem or challenge in ways that contain the motivation necessary to promote focused participation over time. This process is participatory and

involves careful consideration of issues important in students' lifeworlds and what is authentically playful in challenging academic subjects.

A key principle in creating the problem space is that students have the opportunity to work on issues that are important to them (where they achieve their goals as well as the teacher's) and thus in a context which values creativity, communality, humanity, negotiation and empowerment. A C^2 Learn problem space also recognises that all creative decisions have consequences, the impact of which need consideration and deliberation. Thus students and teachers are encouraged to think about the consequences and impacts of their ideas and activities through collaborating to achieve their goal(s). Immersion in the problem space requires students and teachers to ask themselves questions about how any new ideas they generate co-creatively might impact, for good or bad, on the individual, collaborative and communal dimensions of their community. Within the project this ethical element is called 'humanising creativity' (Chappell et al., 2012); it is creativity guided by compassion and shared values. In order to fully achieve this ethical element of C^2 Learn's co-creativity though, students and teachers must also make their decisions about consequences and impact wisely. This means that they need to try to work as trustees of what matters in their community. In combination C^2 Learn co-creativity is therefore 'wise humanising creativity' (WHC) (Chappell and Craft, 2011; Chappell and Jobbins, in press; Craft, 2012).

As students and teachers create wisely and humanely, cyclical developments occur between their creativity and their identity. This is because when they play the game new ideas and designs emerge; this in turn generates change in them as 'makers'. As they create, they collaboratively develop new ideas but as they themselves are the substance of those ideas, they are also developing or 'becoming' themselves. Slowly, small changes to students and teachers accumulate to contribute to 'journeys of becoming' (Chappell et al., 2011). These individual journeys accumulate together, embedded within an ethical awareness of the impact of creative actions on the group. Through this process small-scale creative changes or 'quiet revolutions' can take place for the group as a whole (Chappell et al. 2011). WHC occurs in C^2 Learn through both the analogue and digital environment.

The C^2 Learn digital gaming and social networking environment will also include a non-linear thinking technique called 'creative emotional reasoning' (CER) (Scaltsas and Alexopoulos, 2013) embedded within WHC to foster co-creativity. CER requires teachers and students to reframe problems, dilemmas and issues as a result of an intervention, such as a random word, image or emotion (generated in C^2 Learn through digital tools) in order to trigger new responses to those situations. Through problem posing and goal setting, students' and teachers' thinking can therefore be changed by using C^2 Learn tools to disrupt their established routines and patterns.

There are four key defining features of the C^2 Learn digital gaming and social networking environment which facilitate co-creativity made to foster WHC and CER. The game environment is designed to allow for 4Ps (Craft, 2011):

- *pluralities*: opportunities for players to experiment with many different places, activities, personal identities, and people
- *possibilities*: opportunities for possibility thinking, transitioning from what is to what might be, in open possibility spaces
- *participation*: opportunities for players to take action, make themselves visible on their own terms, and act as agents of change
- *playfulness*: opportunities for players to learn, create and self-create in their emotionally rich, virtual and actual play-worlds.

Ultimately, co-creativity in C^2 Learn will be evident in five linked ways within this proposed digital gaming and social networking environment (Alexopoulos et al., 2012) as students and teachers collaborate to:

- generate, explore and see how new ideas can have a valuable impact on their community,

- leaving aside ideas that do not relate to what matters to them (**attending to ethics and impact**);
- ask questions, debate between new ideas, find ways to negotiate conflict or to go in a different direction to fellow players if conflict is not resolved (engaging in dialogue);
- take charge of different parts of the creative process, making decisions and understanding their consequences within the rules of the game, as well as taking actions through scenarios and perhaps quests (**be in control**);
- be immersed in the game and its environment, and possibly addicted to gameplay and the interactive drama played out in the game-world and in real-world spaces. This might lead to gamers taking risks and coming up with surprising individual or shared ideas (**engaged action**); and
- have their thinking and action disrupted by the game's computational tools embedded within which are CER non-linear thinking techniques. This will move them away from established routines and patterns (**intervention resulting in reframing**)

Within the C²Learn problem space students and teachers can come up with new ideas which are held onto and used because they are valuable to the community. They will generate these with shared control immersed together, in a dialogic rather than hierarchical environment, and this will foster ethical awareness. C²Learn co-creativity is about these five elements in combination making them more than the sum of their parts.

C²Learn co-creativity, then, which seeks to foster quiet revolutions, will be fostered in a digital gaming and social networking environment designed with game elements using analogue and digital techniques including challenges, feedback, points, levels, rewards integrated within classroom practice informed by a scenario-based context with close attention to the delicate balance between intrinsic and extrinsic motivation. We aim to harness students' motivation to challenge 'what is' and to generate, by working with others, 'what might be'.

C²Learn's integrated gameful learning design

C²Learn is conceptualised as an integrated gameful design encompassing a digital gaming and social networking environment which we refer to as the C²Space. Here students and teachers work to open a 'problem space' or a 'challenge space' which may be integrated with pre-existing or emergent classroom-based educational scenarios to encourage engagement and co-operation (Koulouris and Dimaraki, 2014). Within this problem space, students and teachers articulate goals they can achieve through action (what a user can perform or do) and playful experiences. The C²Space allows students to draw on their gaming literacy (Apperley and Walsh, 2012) and systems-based literacy practices (Walsh, 2010) to interact creatively and collaboratively with each other. An important principle in generating the problem space is that students have the opportunity to work on issues that are important to them (where they achieve their goals as well as the teacher's) and thus in a context which values creativity, communality, humanity, negotiation and empowerment. A C²Learn problem space also recognises that all creative decisions have consequences the impact of which need consideration. Our gameful learning design poses questions to teachers to encourage participatory creative approaches with a focus on the consequences of creative decision-making:

- How can you encourage a focus on issues important in students' own lifeworlds?
- How can you negotiate articulation and enactment of both your own goals as teacher, and goals of your students?
- How does your C²Learn classroom value students' creativity?
- How can you set up approaches to learning which enable students to work with others generating responses to the problem that draw on and expand their humanity?

Our gameful learning design envisions the C²Space as a playful space where analogue and digital activity are appropriately integrated. It is also permeable – in other words accessible outside of school space and time. And it will enable students and teachers to engage productively and creatively

together and will stimulate depth of engagement (engaged action) by students. Overall, it will facilitate students' identity development, enabling their actions to 'form' them, by making and being made, thus engaging in 'journeys of becoming'.

In the C²Learn problem space a situation in which the students engage is problematised such that creative but ethical decision-making is involved/required. Thus students are:

- offered opportunities to identify / find problems as well as solve them;
- challenged to 'reframe' problems and solutions (of others);
- encouraged to generate novelty in ideas and actions; and
- expected to consider the ethics and impact of their ideas and actions.

The playful nature of the C²Learn problem space means that students are engaged in role-taking ('as if') behaviours as well posing 'what if' questions. The C²Space will also encourage students to question assumptions, and thus to generate 'quiet revolutions'.

Our gameful learning design offers starting-point questions for game designers (below) that can assist them to generate such a context and to set the stage for students' engagement and interaction. We believe these same questions can guide the design process of gameful learning systems, on which there is little systematic work (Deterding et al., 2013). In addition, these would help them avoid the problems which existing gamification applications and design methods have been criticised for and would help them to: *be systemic*; *appeal to game-characteristic motivations*; *be user-centric*; and *transcend the application of existing patterns* (Deterding, 2013). Thus our gameful learning design, is *not* about conveying learning (e.g. the curriculum content), rather it is about facilitating action (playtesting) where students (and teachers) are collaborating to address the problem or challenge identified (in the problem space) in fun, non-confusing and engaging way that fosters co-creativity as they engage with challenges, model skills and receive feedback.

Questions include:

- How can you be sure that the issues in focus are important to students (system users) – how can the system help to generate these issues (e.g. open their own problem spaces or design challenge quests)? (*user-centric and transcends the application of existing patterns*)
- How can you ensure opportunities for students to work together and to negotiate goals (articulate a particular game state) such that they generate goals that are communally owned and that the community wants to achieve? (*appeals to game-characteristic motivations: challenges*)
- How can you ensure that the problem spaces the students open is posed so as to require action that might have outcomes which require thinking carefully about the impact on others? (*User-centric, transcends the application of existing patterns and WHC*)
- How can you make sure that this problem space is a fun one? (*systemic and appeals to game-characteristic motivations: varying and increasing challenges*)
- How can you ensure the entities (tokens) the system (CER) provides students are ones they can act upon, where their configuration embodies the game state (Deterding, 2013)
- What are the rules (algorithms) of the system and how will they effect the students' actions in the problem space? (*user-centric, systemic and appeals to game-characteristic motivations*)
- How will the challenges emerging from the problem space be identified and how will C²Learn's co-creativity skills be 'mastered' (*user-centric, appeals to game-characteristic motivation and not pattern-bound*)
- How can you ensure that students get the chance to engage deeply with this C²Learn problem space through giving and receiving feedback? (*systemic, appeals to game-characteristic motivations, user-centric and transcends the application of existing patterns*)
- How can you ensure that this problem space will support students' personal development and enable them both to form or make, and be formed, or be made? (*user-centric, but aligned with*)

some outer purpose to foster co-creativity, systemic and appeals to game-characteristic motivations: challenges that spark curiosity)

If these questions are considered before the design of the C²Learn space, we believe it has real potential to leverage games' deeply satisfying properties (e.g. agency, emotion, and immediate feedback) by providing students with 'playful experiences', or C²Experiences where they autonomously and collaboratively: explore; face and overcome challenges; play games to assist them in reaching their goals; connect with others by engaging in fun and meaningful activities; compete and evidence *compassion and shared values* or *put forth new ideas* that required other students to imagine new ideas; *to shift from 'what is' to new possibilities of 'what might be'*. In this journey they are assisted by each other and artificial intelligence (AI) or C²Learn Co-Creativity Assistants that interact with the students (and/or teachers) to:

- enable them to use mechanisms of creative thinking
- use their imagination (embodied through a wide range of activities including the arts, technology, sports, etc.) to break with ordinary classifications and to perceive openings in the taken-for-granted;
- propose them resources, routes, strategies;
- inform/alert them; and
- expedite tasks and processes and facilitate concentration on collaborative creative thinking.

Gameful learning design to increase intrinsic motivation

Engaging game affordances including those which are *systemic; appeal to game-characteristic motivations; are user-centric; and transcend the application of existing patterns* (Deterding, 2013) as well provide feedback and promote agency, *over* gamified elements such as points, levels, and rewards or badges drawn upon in a non-game framework, are better suited for C²Learn because they motivate students and increase their intrinsic motivation and capacity for active learning in a way which is more sympathetic to the wider goal of WHC. This is achieved through playful C²Experiences—as opposed to game—orientated strategies.

This intentional stance addresses the widely theorised critique of gamification within game studies which argues such game oriented strategies provide primarily extrinsic reward motivators (Nicholson, 2012a) that rely on operant conditioning (rewards, points, limited meaning). Extrinsic motivators lower the potential for fostering creativity (Amabile, 1997) and co-creativity. By employing a gameful learning design first, before the design of the system, C²Learn's environment will be better placed to increase intrinsic motivation by paying careful attention to the match between task and learner and the careful construction of learning groups (Amabile, 1997) Although undertaken in business contexts, Amabile's studies reveal the importance of diversity of perspectives in any effective co-creative teamwork and are frequently applied in other contexts including the classroom. Forming groups or teams with diverse talents and ways of working, is an important aspect of the teacher's role. As well as diversity, teams must share excitement over their (shared) goal/s. They must show collaborative willingness to support and help one another through difficulties and they must acknowledge unique perspectives brought by others in the team. In addition to this, leaders of a creative process (which in C²Learn might include students as well as teachers), must be ready to acknowledge new and useful ideas, as a culture of negative evaluation, and one where high quality individual and group contributions are not actively and consistently valued, seriously undermines motivation toward creativity and thus kills creativity. Amabile shows through her work that modelling creativity through behaviours that encourage collaboration and communication and which acknowledge the value of perseverance also, is an important aspect of leadership of co-creativity. The intention in C²Learn—from the educators' perspectives—is to capitalise on gameful design to encourage the features of co-creativity. This is because C²Learn understands people enjoy playing games because they are having fun, in control and can potentially affect the gameworld through their meaningful choices and decisions. They play games because they are challenging and filled with clear goals and they are so

enjoyable that winning is irrelevant, what is relevant are the pleasurable and playful experiences.

Engagement in C²Learn, then, attends to intrinsic motivation by providing elements of game design in the C²Space through 'playful' activities that spark deep attention, motivation and curiosity. Our intention is to harness students' motivation and engagement through enjoyable learning and a goal-oriented approach that is enhanced by Wise Humanising Creativity (WHC) outcomes discussed earlier. The analogue and digital aspects of gameful design in the context of C²Learn will also be informed by educational scenarios, appropriate for a range of contexts and learners, and addressing specific learning objectives, and further contextualise this project's careful and creative criticality in relation to the act of game design.

Conceptualisations of C²Learn practice

When conceptualising our gameful learning design, we realised we need to provide the game designers greater pedagogical insight into what types of activities need to occur in C²Learn, to ensure that learning system, yet to be designed, assists students and teachers in participating in active *processes of change* guided by compassion (i.e. close and active awareness of the needs and hopes of others) and reference to shared values through playful experiences that capitalise on what we know is 'good' gameful design.

An intrinsically motivating gameful system offers nested and interlinked feedback, loops of goals, actions, tokens and feedback around the skills-based challenges inherent in users' pursuance of their goals while engaging with the system. (Deterding, 2013, p. 3)

We see this motivating system as one where teachers and students participate in an environment with experiences that are fun and help them achieve their goal(s) emerging from their definition of the 'problem space' or a 'challenge space'. These goals are derived from users' collaborative thinking, shared action, gameplay and social interaction within a living dialogic space to foster WHC through CER's set of core creative learning tools.

Ultimately, C²Learn is about fostering co-creativity in learning. Learners, individually as well as primarily collaboratively and also communally, come up with novelty, new ideas. These new ideas:

- Have emerged through asking 'what if' and 'as if' questions and through the use of disruptive techniques resulting in re-framing;
- Have emerged from shared ideas and actions in an immersed dialogic rather than hierarchical environment/system; and
- Are captured or selected because they matter to the community and have a valuable impact on it.

Students and teachers are required to take into account the impact of that novelty on the individual, collaborative and communal dimensions of their community.

Students and teachers are motivated to be creative not just for the sake of creativity in isolation (*'I am being creative on my own and don't care if the others value this or not'*); rather, they are motivated co-creators because they recognise the value of their creativity for themselves and the others. They also confront the challenge of getting others to recognise and appreciate their creative activity, since the real value of this creativity materialises mainly in the group and the community through dialogue, action, immersion and being in control and not merely within the creator. The challenge is to design a gameful learning system that does this while also affording the playful framing of the users' engagement within it (Deterding, 2012).

In a gameful system designed this way, students and teacher move away from learning about unquestionable facts, to thinking differently and questioning the obvious and widely believed, toward

generating new ideas, proposing new solutions and implementing changes, feeling, understanding and responsibly managing the usefulness and impact of novelty on themselves and the others - being intrinsically motivated to do these things through gameplay and interacting with other users and the artificial intelligence.

A major gameful system design challenge is articulate how the goal of reflection on their co-creativity can be made possible, particularly if this is a core skill that the students and teachers need to master. In regard to co-creativity, they must reflect on the value and impact of their creativity, as well as on how they and the others may be changing little by little during this adventure, what this change looks like, what has enabled it and where it is taking them next.

What C²Learn's gameful learning design looks like in practice

Utilising the affordances of currently available examples of the project's game prototypes and digital tools, this section presents what our gameful learning design *could* look like in practice (depending on what affordances are possible from the perspective of the system's designers within the reality of the project's budget).

C²Learn's gameful learning design is an ensemble of four interwoven elements to design a 'playful' C²Space where students and teachers engage in C²experiences assisted by artificial intelligence (AI):

- A. **The co-creativity element** driven by **Possibility Thinking** involving 'what if' and 'as if' questions, which enables users to imagine new ideas and to shift from 'what is' to new possibilities of 'what might be', provides a foundation of opportunities for the intervention and reframing involved in **creative emotional reasoning** and the ethical impacts, dialogue, control and engaged action of **wise humanizing creativity**. Together this generates shared change. In C²learn co-creativity, possibility thinking is integrated with **Creative Emotional Reasoning** in which learners generate new ideas together through the use of disruptive techniques for semantic, diagrammatic and emotive lateral thinking which results in reframing.

which involves:

- B. The **social engagement element** via a 'Living Dialogic Space' defined by flattened hierarchies enabling dialogue, and the use of brainstorming activities, which together enable individual, collaborative and communal thinking. This occurs through **immersion** in the C²Space and **collaboration** with fellow users, both inside and outside the digitised learning environment.

which fosters:

- C. The element of **Ethics and Impact Awareness**, in other words generating novel and valuable ideas evaluated by students for their ethical impact, and selecting and enacting those ideas because *they matter* to the community and have a valuable impact on it. Involvement in this ethical dimension has the effect of both forming and being formed through dialogue and illustrates the the co-creative 'outcomes' via Wise Humanizing Creativity.

which all occurs in the context of:

- D. The element of the wider picture of change ('journeys of becoming' and 'quiet evolutions' via cyclical developments between creativity and identity illustrated in Figure 1) through gameplay and social engagement in the C²Space over time where users make their decisions about consequences and impact wisely. Thus over time, cyclical developments between creativity and identity occur. Thus, students and teachers enable change and reflect on change in longer periods of co-creative activity.

The characteristics of student behaviours in C2Learn co-creativity and identified by the project team as the co-creativity evaluation criteria, are evident as students foster new, valuable ideas through:

- Accepting and generating intervention and reframing
- Attending to the ethics and impact of ideas
- Involvement in dialogue
- Being in control
- Engaging in action or being immersed in the experience

Examples are presented below of what learners and teachers typically do in each of the elements of co-creativity, and of how the gameful learning design was conceptualised to help facilitate and further empower them to engage in C2Learn’s co-creativity.

C2Learn action and engagement can be seen as taking place within a wider face-to-face and virtual pedagogical environment of co-creativity, which includes several core episodes of co-creativity and creative thinking. At large, these two levels of activity (wider environment and core episodes) correspond to the C2Spaces’ core C2Experiences (C2Explorations consisting of C2Games, C2Explorations and C2Fun). Students’ digital and face-to-face involvement inherently involves what the project calls the 4P’s of participation, possibilities, pluralities and playfulness. Table 1 illustrates how the elements A.-D. above are mainly evident at these two levels:

Table 1: Four interwoven elements of C2Learn practice

	Wider environment of co-creativity <i>(corresponding to the C²Space)</i>	Core episodes of co-creativity <i>(corresponding to the core games and ‘playful’ activities)</i>
<p>A1. Creative thinking (driven by ‘Possibility Thinking’ provides a foundation of opportunities for the intervention and reframing involved in creative emotional reasoning and the ethical impacts, dialogue, control and engaged action of wise humanizing creativity)</p> <p>A2. Creative thinking formalized <i>(‘Creative Emotional Reasoning’)</i></p>	<ul style="list-style-type: none"> • Creative thinking that has taken place within core episodes leaves its traces in the wider environment. • In the wider environment, co-creators can reflect on the creative thinking that has taken place within the core episodes. 	<ul style="list-style-type: none"> • Creative thinking lies in the heart of each core episode; core episodes are formed around tasks or initiatives of creative thinking. • Part of the creative thinking in a core episode may be formalized, applying CER techniques.
<p>B. Social engagement (via a ‘Living Dialogic Space’ defined by flattened hierarchies, involving individual, collaborative and communal thinking, through immersion in the C²Space t and via collaboration)</p>	<ul style="list-style-type: none"> • Social engagement that has taken place within core episodes leaves its traces in the wider environment. • In the wider environment co-creators can reflect on social engagement that has taken place within the core episodes. 	<ul style="list-style-type: none"> • Co-creators are involved in social engagement of various kinds within each core episode.
<p>C. Ethics and Impact Awareness Element: novel and valuable ideas evaluated by students for their ethical impact (both forming and being formed through dialogue ie co-creative outcomes via Wise Humanizing Creativity)</p>	<ul style="list-style-type: none"> • Ethics and impact considerations that have taken place in relation to new ideas within core episodes leave their traces in the wider environment. • In the wider environment, co-creators can reflect on the ethics and impact considerations that have taken place within the core episodes. 	<ul style="list-style-type: none"> • Co-creators consider ethics and impact within each core episode.

<p>D. Wider picture of change Element</p> <p>(‘Journeys of Becoming’ and ‘Quiet Revolutions’ through gameplay and social engagement in the C²Space over time where gameusers make their decisions about consequences and impact wisely)</p>	<ul style="list-style-type: none"> • In the wider environment, co-creators may make wider plans for change, setting relevant goals. • Traces from the core episodes may provide evidence of wider change. • Co-creators reflect on these and more generally on the C2Learn experience. 	<ul style="list-style-type: none"> • Each core episode contributes to the wider change, but the wider change is not (necessarily) an explicit focus in each core episode.
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Overall, the core episodes of co-creativity are typically characterized by ‘playful’ activity and a faster pace, while the wider co-creativity experiences (C²Experiences) affords a slower pace of taking stock of the activity that occurred in the core episodes and the overall experience.

Illustrating the possibilities of C²Learn’s gameful learning design utilising the project’s game prototypes

Whilst we are still working as a consortium on how the C²Space will be designed to incorporate our gameful learning design, we can offer insight into how C2Learn practice might manifest via C²Experiences. This is presented using the four elements from Table 1 above, adapted to give examples for the project’s 4Scribes game prototype. The 4Scribes example (Table 2 below), is situated within ‘Rescue’ - one of the Scenarios which is in development. In this scenario, students are presented with the dilemma that following a crash of some kind (e.g. aeroplane, space mission, boat), there is a lifeboat/ escape pod available that can take a certain number of people and there are more people than available spaces in the vehicle to save them. Through the 4Scribes narrative game the students need to create the story of who is saved and how.

Table 2: C2Learn Practice in the 4Scribes prototype

	<p>Wider environment of co-creativity (corresponding to C²Space and teacher activity)</p>	<p>Core episodes of co-creativity (corresponding to core games and playful activities and learner activity)</p>
<p>A1. Creative thinking (driven by ‘Possibility Thinking’ provides a foundation of opportunities for the intervention and reframing involved in creative emotional reasoning and the ethical impacts, dialogue, control and engaged action of wise humanizing creativity)</p>	<p><i>digital environment</i></p> <p>The digital environment around the 4Scribes game will be structured to:</p> <ul style="list-style-type: none"> • Provide a private working space in which the player can create possible ‘card’ combinations, experiment with posing problems and solving problems within the ongoing narrative using their set of ‘cards’. • Provide learners with a reflective space or tool to look back over ideas and decisions and reflect and comment on them • Offer users space within which they can experiment with identities for card characters and their look • Link these to the shared narrative space within which the story is collaboratively created and ‘told’ using words, images, drawings and film clips • Provoke users to overcome challenges in developing their narrative at timely intervals by allowing the Creativity Assistant access to the 4Scribes play <p><i>teacher activity</i></p> <p>Once the rules of 4Scribes gameplay are established the teacher will mainly ‘step back’ to allow the flow of play to occur. However if users become demotivated or struggle to develop narrative teachers will step in to:</p> <ul style="list-style-type: none"> • Pose a range of open-ended ‘what if’ questions to re-provok learners to get involved in possibility thinking • Request particular learners pose problems to others and/or pose additional problems to learners themselves • Use the ‘card’ format to provide character-based opportunities for students to engage in ‘as if’ activity of plural kinds re identity • If they are not doing so already, encourage them to experiment with other pluralities within the narrative such as place • Trigger the integration into the activity of intervention and reframing tools or use the Creativity Assistant to intervene in provocative ways in gameplay 	<p><i>games and playful activities</i></p> <p>The 4Scribes game will:</p> <ul style="list-style-type: none"> • Involve users in exploration of eg the Rescue scenario possibility space, or their own newly constructed version of that scenario by: <ul style="list-style-type: none"> ▪ Presenting them with ‘what if’ questions via eg the Creativity Assistant and ‘as if’ environments via creation tools in which they can create backgrounds and characters for the ‘cards’ ▪ Requiring them to pose their own ‘what if’ questions in their private space as well as the public story-telling space ▪ Requiring them to explore and co-construct (designing, editing, extending) character’s features, narrative and environment characteristics <p><i>Learner activity</i></p> <p>When playing 4Scribes users will have to</p> <ul style="list-style-type: none"> • Think about multiple possibilities of narrative direction by working with their existing knowledge and figuring out how to develop that creatively to envelop the narrative (rather than approach the task as knowledge acquisition exercise) • Not only solve but also find problems that will help their part of the narrative develop in an innovative way (eg how can my character create an issue for another character which means they can no longer get into the rescue boat) • ‘Think differently’ and generate new ideas about their characters and the narrative by exploring rescue and personality possibilities and the perspectives of different characters, by: <ul style="list-style-type: none"> ▪ asking ‘what if’ and ‘as if’ questions about card character identity, the place of the crash, the rescue environment, repositioning selves in different roles to understand perspective • Exploring and co-constructing (designing, editing, extending) content within the environment of the public narrative space.

<p>A2. Creative thinking formalized ('Creative Emotional Reasoning')</p>	<p><i>digital environment</i> [as above] and: The C²Space around the 4Scribes game will offer a selection of C2Learn 'disruptors' (e.g. Random Word Generator) to disrupt learner's establishing narratives. Inclusion of disruptors can be set as voluntary or involuntary within 4Scribes.</p>	<p><i>games and playful activities</i> [as above] and</p> <ul style="list-style-type: none"> • Incorporate 4Scribes specific intervention and reframing tasks as interjection in the flow of the story (either voluntary or involuntary) to keep learners thinking differently e.g. introduction of rogue character cards or new dimensions to the scenario above and beyond hands dealt to users
	<p><i>teacher activity</i> [as above] and the teacher:</p> <ul style="list-style-type: none"> • Intervenes either directly within the flow of the narrative to trigger new responses or indirectly (perhaps in students' private work spaces) if they see users getting set within particular narrative pathways • Inserts (and if necessary) facilitates brainstorming tasks when narrative reaches a dead end 	<p><i>learner activity</i> When playing 4Scribes users will have to:</p> <ul style="list-style-type: none"> • Address given challenges that arise through the combination of the Rescue scenario, and the premise and theme setting at the beginning of the 4Scribes game • Reframe these challenges and come up with solutions to how to e.g. rescue 11 people stranded on the moon when the evacuation pod only has enough air for 10: <ul style="list-style-type: none"> ▪ Engage with disruption tools and the creativity assistant activities aiming to change obvious patterns of thought eg Random word 'imminence' may prompt them to think about changing their tactic to one of signaling to be rescued which may be more imminent than they previously thought, therefore negating the need for the narrative to find a way not to save all 11 people ▪ Create new analogies as building blocks of the creative process e.g. thinking about what you do when you have too many items in your basket in the '10 items only queue' in the supermarket ▪ Actively experiment with re-combining elements of the creative challenge e.g. find a way to look on the moon for other crashed spacecraft which may contain air supplies ▪ Actively facilitate a shift of perspective, by uncovering hidden aspects of creative challenge, going beyond the material provided by description (elements) of the challenge, recasting challenge in a new light (as a whole or re-formulating elements of it) e.g. above also cover these activities

<p>B. Social engagement (via a 'Living Dialogic Space' defined by flattened hierarchies, involving individual, collaborative and communal thinking, through immersion in gameplay and social networking in the C²Space and via collaboration)</p>	<p><i>digital environment</i> The environment around 4Scribes will:</p> <ul style="list-style-type: none"> • Assist the teacher's management of individual and group activity as the narrative develops • Assist with teacher's decisions on effective learner grouping for playing 4Scribes (e.g. through information on learners' activity and co-creativity profile) • Via the public space, provide access to, and overview of the developing narrative to the group • Encourage control of personal identity representation via avatars and the way characters are played in the game, in a social-network-style fashion 	<p><i>games and playful activities</i></p> <p>The 4Scribes game will:</p> <ul style="list-style-type: none"> • Especially allow for collaborative and communal activity within the shared narrative space as well as some individualized creative activity within the personal private space • Enable the expression and management of conflict within the narrative in a 'contained' /safe manner, e.g. through opening up ways to explore alternate paths in the developing story. In this situation conflict will need to be resolved or skillful ways found to circumvent unresolved conflict, in order to move the narrative on • Involve shifting leadership roles, as different users take charge of the narrative at different times; this will also emphasize equality of opportunity within the narrative groups
	<p><i>teacher activity</i> The teacher manages the social side of the narrative development by</p> <ul style="list-style-type: none"> • Taking careful decisions on learner grouping (e.g. through information on learners' activity and co-creativity profile) in order to bring together the most conducive groups for WHC narrative development • Focusing where necessary on individual and within group activity, to keep driving the narrative. This may mean paying particular attention to the atmosphere of group discussion. • Helping learners to keep track of the dialogue and negotiation activities within private and public spaces • Helping more reluctant learners to take the initiatives e.g. perhaps in taking a risk regarding changing the direction of the story. • Monitoring emotional impact of storyline developments in relation to the Rescue scenario <p>Doing all of the above in a way which honours flattened hierarchies and the pedagogies of standing back, so e.g. suggesting rather than telling... using tools to insert ideas 'bottom up' rather than ruling from 'top down'</p>	<p><i>learner activity</i> In 4Scribes learners will consciously collaborate and engage socially by:</p> <ul style="list-style-type: none"> • Engaging in dialogue and negotiation in order to develop the narrative around who is rescued or how 11 rather than 10 people are saved: • Taking control of the narrative guided by their 4Scribes cards: • Making themselves visible on their own terms using the personal reflective space and public areas as they like in order to achieve this • Engaging in playful narrative development, together with the others but with an ethically driven purpose to their narrative and a concern for its final impact on the characters

<p>C. Ethics and Impact Awareness Element: novel and valuable ideas evaluated by students for their ethical impact (both forming and being formed through dialogue ie co-creative outcomes via Wise Humanizing Creativity)</p>	<p><i>digital environment</i> The digital environment around the 4Scribes game will be structured to:</p> <ul style="list-style-type: none"> • Allow learners to think about their values regarding who is more worthy of saving in the Rescue scenario in their private space including the reflective facility and to share these values via the characters and narrative they contribute to within the 4Scribes public space • Allow learners to comment and reflect upon the values that they see others expressing about 'worthiness' of characters both within 4Scribes and forum/blog facilities etc. in the environment. • As well as comment and reflect upon the ethical implications of the outcome of decisions to 'save' characters within the narrative via the forums/blogs around 4Scribes • Keep track of ideas and narratives within both the private and public spaces so that learners can reflect on them in their evaluation of worthiness of rescue 	<p><i>games and playful activities</i> The 4Scribes game will:</p> <ul style="list-style-type: none"> • Provide ethically challenging choices /dilemmas /problems such as the Rescue scenario involving characters not usually within their experience which allow students to step out of their everyday 'narrative' and 'values' and challenge them to see situations from new ethical perspectives
	<p><i>teacher activity</i> Once the rules of 4Scribes gameplay are established the teacher will mainly 'step back' to allow the flow of play to occur. However if users become demotivated or struggle to develop narrative teachers will step in to help learners to:</p> <ul style="list-style-type: none"> ▪ Clearly define and express their shared values through using private and public spaces and reflection tools effectively to consider the impact of saving characters ▪ Explore the impact of the innovative solutions such as signaling for rescue rather than trying to use the rescue pod to escape, via discussion in online forums/blogs and of the overall creative activity, and/or with the teacher 	<p><i>learner activity</i> When playing 4Scribes users will have to</p> <ul style="list-style-type: none"> • Consciously and systematically position themselves, their avatars (plural identities) and their generated solutions to the Rescue dilemma, in relation to their values, those of their imaginary group (astronauts awaiting rescue), and of the community (space mission), through dialogue • Explore through dialogue the good and bad consequences of deciding who to save, or of waiting to be rescued, and other solutions with their peers, their group, the community • Select through dialogue the solution driven by the values of their imaginary group (space mission), and actively promote those which are deemed valuable by the group
<p>D. Wider picture of change Element ('Journeys of Becoming' and 'Quiet Revolutions' through gameplay and social networking in the C²Space over time where user make their decisions about consequences and impact wisely)</p>	<p><i>digital environment</i> The C²Space around 4Scribes will offer means to:</p> <ul style="list-style-type: none"> • Integrate learning from the 4Scribes game into previous and future shared goal setting • Keep track of collected ongoing narratives so that learners can reflect on them in their evaluation of wider change 	<p><i>games and playful activities</i> The 4Scribes game will:</p> <ul style="list-style-type: none"> • Offer students opportunities to change the rules and assumptions of the game so as to create new and possibly their own narrative
	<p><i>teacher activity</i> Within 4Scribes the teacher will</p> <ul style="list-style-type: none"> • Facilitate the learners to reflect on their changing thinking across a number of different narratives and to connect these to the wider picture of change across the C²Learn experience 	<p><i>learner activity</i> Within 4Scribes learners will</p> <ul style="list-style-type: none"> • Be able to reflect on how they and their thinking has changed within different versions of the narrative • Set goals for themselves and their group aiming at creative change through the narrative; this is important in other words that this game affordance allows engagement with real-world as well as fictional contexts

Conclusion

In order to fully foster co-creativity, and prevent C²Learn becoming 'locked down' in tight scenario-based activities, C²Explorations will need to be embedded within a wider 'learning design unit' which allows for the space and flexibility necessary for living dialogic spaces, co-creativity and ultimately journeys of becoming, within the classroom and beyond it. Having further articulated C²Learn practice in terms of the four elements of Creative Thinking, Social Engagement, Ethics and Impact Awareness and the Wider Picture (which incorporate the previous five categories of co-creativity), we articulate our gameful learning design's goals and indicators through the example of the 4Scribes game prototypes and what indicators or core episodes of co-creativity might look like. The format of Table 2 was adapted so as to include the C²Space and teacher activity in the wider environment of co-creativity column; this is because these two are the main contributors to fostering co-creativity. The games and playful activities and learner activity have been included in the core episodes of co-creativity column because these are the two main places where co-creativity will manifest.

In providing the example of the 4Scribes, we illustrate how a gameful learning design is needed first, rather than adding a 'game layer' to a system if the goal is to design a digitised learning system where users freely explore ideas, concepts and shared knowledge and engage in creative problem-finding and problem-solving—individually, collaboratively and communally—assisted by the system's artificial

intelligence (AI). A gameful learning design approach like the one we illustrated, best exemplifies how game affordances that are *systemic; appeal to game-characteristic motivations; user-centric; and transcend the application of existing patterns* (Deterding, 2013) are suited to motivate children and young people by increasing their intrinsic motivation to foster co-creativity.

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