HORIZON2020 FRAMEWORK PROGRAMME
ICT – 21 -2014
Advanced digital gaming/gamification technologies

Gamification of Prosocial Learning
for Increased Youth Inclusion and Academic Achievement

D4.3
1st Prosocial Game Mechanics
The Prosocial Skill Games Model which is an abstract game model for teaching prosocial skills is presented. The first iteration of the Prosocial World Data Model for use in prosocial games is presented. The first iteration of a range of game mechanics and game systems together with rules intended to produce game play that leads to increased proficiency in prosocial skills is presented.

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<tr>
<td>EC</td>
<td>European Commission</td>
</tr>
<tr>
<td>PGC</td>
<td>Prosocial Game Canvas – see also D2.6 Chapter 5</td>
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<tr>
<td>GM</td>
<td>Game Master</td>
</tr>
<tr>
<td>ID</td>
<td>Instructional Design</td>
</tr>
<tr>
<td>MDA</td>
<td>Mechanics, Dynamics, Aesthetics</td>
</tr>
<tr>
<td>PSGM</td>
<td>Prosocial Skill Game Model</td>
</tr>
<tr>
<td>AI</td>
<td>Artificial Intelligence</td>
</tr>
<tr>
<td>XNA</td>
<td>XNA’s Not Acronymed (a freeware toolset by Microsoft for game development)</td>
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**Executive summary**

We present an abstract model for developing games that teach prosocial skills which takes into account a range of prosocial learning situations including preparation, player actions, context, evaluation, outcomes and generalisation. We also present the first iteration of the Prosocial World Data Model to be used in prosocial games. Additionally a range of game mechanics including reward and feedback system, trade, alliance, narrative, shared resource, social dilemma, roleplay, conflict, mutual goals and collaborative action have been described together with examples the provides the rules and methods intended to produce game play that leads to increased proficiency in prosocial skills. The rules for game mechanics such as reward and feedback have been defined as a means to provide adaptation points and constraints such that games can adapt to provide individual outcomes to each player’s actions with respect to the context and evolving game world situations.
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1 Introduction

This section provides detailed information about the purpose, scope and structure of the document as well as the intended audience of the document.

1.1 Purpose of the document

In this deliverable we provide an abstract game model for Prosocial Skill Games, the first iteration of the Prosocial World Data Model, and description of a series of game mechanics and systems as applied to learning prosocial skills.

We begin by exploring the academic and commercial domain of game models and model driven development, leading to the presentation of the abstract model for Prosocial Skill Games encompassing preparation, assessment, player action, evaluation, context, debriefing, generalisation and impacts on real world rewards. This abstract model is then operationalised into the Prosocial World Data Model consisting of player, NPCs, Group, Game Master, Skill, Action, Outcomes, Resources, Narrative, Evaluation and Context.

Finally we present a variety of prosocial game mechanics and game systems which build on and extend common game patterns found in the leisure gaming industry. The methods and processes described are generalized such that they can be readily applied in a variety of other game mechanics depending on the interests of the game developer.

1.2 Scope and Audience of the document

The dissemination level of this document is public. This deliverable builds on the existing efforts in WP2, WP3 and WP4 and provides the foundation of the game-tracked attributes of Prosocial API, which will be developed further in Task 4.3 and presented in D4.4. Additionally it supports further developments in WP4 in particular for the adaptation manager and provides the method and examples for prosocial game mechanics in the games developed in WP6.

1.3 Structure of the document

The document contains the following sections:

Section 1: Introduction – the introductory section including purpose of document and scope and audience.

Section 2: Game Model – overview of existing game models, models for game based learning, description of the prosocial skill game model and prosocial game canvas.

Section 3: Prosocial World Data Model – introduction and description of the prosocial world data model which seeks to operationalize the conceptual prosocial skill game model.

Section 4: Game Mechanics in Prosocial Games – description of a range of prosocial game mechanics extending game patterns found in the leisure gaming industry including reward, feedback, trade, allicance, etc.

Section 5: Conclusions – summary of the deliverable.
2 Game Models

Over the years the number of methods, and tools developed to support and assist game designers have included frameworks, vocabularies, design patterns, state machine diagrams, Petri nets and a range of game diagramming tools. There is little common academic discourse on frameworks to describe games and the use of game models are diverse. Additionally it is widely acknowledged that not everyone in the games industry sees the benefits of methodological approach to game design. The most common arguments against the use of models are that they have little practical value for game design and can not replace the creative process of designing games. However, despite the skepticism from some in the game industry, such tools are more than toys for academic curiosity and indeed can be used to explore a variety of game designs and formalise the approach to description of high level game mechanisms and their interaction.

A game model provides an abstraction of the relationship between the various constituent components of the game. It can be used to describe the underlying mechanisms that drive the interaction and determine how the various elements relate and impact each other. Different game model approaches exist today

- **Game theory**: uses mathematical models to describe the variety of situations and strategies that could lead to a range of outcomes. These models are popular with economists and statisticians far more than video game developers.

- **Video game research**: uses generics derived from video game research. MDA (mechanics, dynamics and aesthetics) is the most widely used game design framework within the game’s industry and has been the topic of extensive research (Hunicke et al. 2004; LeBlanc 2004,2006). It deliberately presents a generic approach to the process of game design.

![Figure 1 The MDA framework](image)

- **Game-based learning**: seeks to provide frameworks for designing learning games and in particular seek to integrate learning-theory together with motivational aspects and interaction elements. Frameworks developed in GBL approach games as a medium for conveying learning contents, sharing elements from Instructional Design (ID) as well as game development.

Whilst game models from GBL research are concerned largely with the theoretical pedagogical and ludic underpinnings of the games at a high level overview of interactions, game models from a software engineering perspective, dubbed model-driven engineering (MDE) or Model-Driven Development (MDD) seek to provide a pragmatic methodologies that represents the systems under-study with subsequent generation of operational software artefacts.
There are no established models relating game mechanics to specific skills acquisition. This is partially due to game mechanisms being applicable to a large variety of contexts. Mapping a skill to a mechanic is therefore unlikely to be appropriate beyond a particular use-case, rather than a totality. As an analogy, one may consider the idea of a specific word being best suited for telling a particular story, of course any writer would reject such an idea, as the word only makes sense in context and any word could be used in a story so long as it’s use is consistent with the context. Arnab et al. (2014) have developed a framework that attempt to map learning mechanics to game mechanics, however the framework remains an ideation tool rather a diagnostic or development tool.

### 2.1 Models for games based learning

In this section we explore a variety of game models and frameworks from diverse academic and industry sources, particularly paying attention to models from game based learning and model-driven game development. The purpose is to explore relevant previous efforts and references that inform the prosocial skill game model presented in section 2.4.

**Game Object Model (GOM),** as developed by Amory and Seagram (2003) and extended (Amory 2006), aims to provide a model that supports concepts that educational computer games are deemed necessary to include: being relevant, explorative, emotive, engaging and include complex challenges; support authentic learning activities and have the ability to be explored through multiple representation and reflections.

Within the Game Object Model the core definitions provided are game definitions, authentic learning, narrative, gender, social collaboration and challenge-puzzle-quest. Games are seen as inherently emotional experiences. Educational games should thus present relevant, explorative, emotive and engaging environments where solutions to complex challenges require multifarious dialogues.

- **Authentic learning**, and the sense of utility is a required element of educational games. Whereas instructional games should include skills, knowledge, and values that allow the player to experience how to think, behave and solve problems. (Gee 2005)

- **Narrative**, defines the relationship between gameplay and story. Whereas a ludologists may be primarily concerned with the mechanics of gameplay, a narratologist may view games as a method of storytelling. In reality narrative helps to define the purpose and frames the experience. The game mechanics may require resource acquisition say by clicking a button, but the narrative provides the context that gives purpose and meaning to the action.

- **Gender**, makes a difference in intrinsic interests of players. (Bonanno and Kommers 2005, Crawford and Gosling 2005, Ray 2004). Therefore educational games must be gender-inclusive; more use should be made of activity-based interactions (sometimes referred to inquiry based or experiential interactions) that are not hidden behind the scenes by support the rhythm of the game. Conflict ought to include both ‘I win/you lose’ and indirect non-confrontational outcomes, and include appropriate role models.

- **Social Collaboration**, refers to learning as a product of social practice. In particular dialogue as one of the cornerstones of social constructivist view of learning. Social capital refers to working through information flow, altruism, reciprocity, collective action and identities, in order to support all players from understanding their own relationships with a community and develop new insights and perspectives.
• **Challenges-puzzles-quests**, refers to many of the core activities associated with educational games. Accommodation, assimilation and puzzlement must be supported through access to explicit knowledge, conversations and reflections that enable the results to be constructed into tacit knowledge.

![Game Object Model Version II](image)

**Figure 2 Game Object Model Version II**

*4D Model* proposed by van Staalduinen and de Freitas (2010), brings together four dimensions for developing applied games which includes: Learner Specifics, Pedagogy, Representation and Context. This model was further enhanced by Ahmed et al. (2015) in the *Multi-Domain Framework for Modelling Educational Games* which extends the model to 139 game components as shown in the diagram below.
Figure 3 Multi-Domain Framework for Modelling Educational Games

Model for Education Game Design proposed by Song and Zhang (2008) combines flow experience and motivations by suggesting seven basic requirement for an effective learning environment, nine dimensions of flow experience and four essential strategy components for motivation. Figure 4 describes the outline of the model.

Figure 4 Model for Education Game Design
Experiential Gaming Model proposed by Kiili (2005) aims to help designers understand the learning mechanisms in games by integrating pedagogical aspects into the game design process.

Figure 5 Experiential Gaming Model

Structural Playability Design Model proposed by Bradshaw (2007) aims to provide a model to visually represent the psychological process of learning gameplay to an audience of game developers in a way that they could equate to their own working practices. It represents a preliminary system for mapping in-game playability.
Bradshaw (2007) has based his approach to modeling game development for skills on Fitts & Posner (1967) and Schmit & Lee (2005) models for the 3 Phases of Skill Learning. The “three-phase” view of learning as imagined by Bradshaw (2007) are; The Cognitive phase, where the learner tries to understand the task and what is being demanded from them, the associative phase, where the learner carries out the skill in context, and finally the autonomous phase, where the learner carries out the action.

The Design Framework for Edutainment Environment, as developed by Embi (2008) aims to provide a high level framework for providing customisation of educational games based on the psychological...
needs of the learner. At its heart the model refers to psychological needs and user motivations which give rise to interactivity that then maps to the curriculum goals.

2.2 Model Driven Game Development Frameworks

In this section we cover both academic and commercially oriented model driven engineering approaches. This exploration is relevant in the light of developing solutions within the project that may encourage deeper engagement from the player through their active participation in defining the games. For example by providing a game making application, where players can make simple mini-games around prosocial skills, which they can play together with their peers.

Model driven engineering (MDE) process is generally defined as a encompassing a sequence of activities; beginning with identifying the level of abstraction and technologies, specifying notation and syntax to be used, specifying refinement processes and platform related information, where applicable defining generators and specification for verifiers and validators to check the generated results against higher level abstractions.

A typical process for MDE includes domain expert models of the sequence of activities to produce a domain model which can be transformed into game models either through using language or visual tools, without the requirement of actual game development. Examples of MDE from academia includes SharpLudus (Furtado and Santos 2006), Model-Driven Game Development (Reyno and Cubel 2008) and Model-Driven Framework for Game-based Learning (Tang and Hanneghan 2010). More recently a number of commercial products have introduced some key concepts of MDE in the form of visual programming for games, notably PlayMaker\(^1\) from Huton Games and Kodu\(^2\) from Microsoft.

SharpLudus Game Software Factory developed by Furtado and Santos (2006) is one of the earliest attempts at a model-driven approach for defining games, consisting of a domain-specific modelling language, a semantic validator and a code generator. The associated software and toolkit for the SharpLudus Game Software Factory have not been maintained since 2009 however. Model-Driven Game Development (MDGD) developed by Reyno and Cubel (2008) uses a Unified Modeling Language (UML) diagrams to gather requirement information and automate generation of program code for 2D platform games. The system which was developed to enhance productivity in terms of quality, time and cost. However it appears to have only been used for limited research purposes. The MDGD developed by Tang and Hanneghan (2010) aims to provide automatic generation of software through visual modeling particularly for those with limited or no technical knowledge to produce their own game based learning solution. However once again it seems their efforts did not extend beyond a rather simplified XNA template, and was not taken up by the games industry.

PlayMaker, is a development extension for Unity3D game engine, Unity3D is a popular game development environment. The purpose of PlayMaker is to enable artist and designers to realise their creative vision and develop games without the need to write traditional code. PlayMaker makes

\(^{1}\) Playmaker is created by Huton Games, see [http://www.hutonggames.com/](http://www.hutonggames.com/)

it possible to quickly make gameplay prototypes. Similarly Kodu is a visual programming tool which builds on projects such as Squeak\(^3\) and Alice\(^4\) to allow ‘anyone’ to make games using visual elements.

Whilst commercial offerings such as PlayMaker, aimed at less technically proficient game developers, and Kodu, aimed at young players, are successful. The academically driven MDE which attempt to encompass the entirety of the development cycle do not appear to be in widespread use in the games industry. This leads to the conclusion that whilst MDE could be offered in a research oriented project, in a commercially focused project the use of visual programming and templatification of the development process may be better suited in broadening adoption.

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\(^3\) First developed in 1996, Squeak is a programming language that provides tile based visual programing scripting. See [http://www.squeak.org](http://www.squeak.org)

\(^4\) Alice is a freeware object-based educational programming language and integrated development environment see [http://www.alice.org](http://www.alice.org)
2.3 Prosocial Skill Game Model

In chapter 5 of deliverable D2.6 Prosocial Game Design Methodology we provided a Prosocial Game Canvas (PGC). PGC is analogous to other successful visual design tools such as the Business Model Canvas\(^5\) and the Customer Journey Canvas\(^6\). The PGC defines 13 distinct elements for consideration by a game designer whilst defining and designs games that teach prosocial skills, these are: audience, inspiration, resources, outcomes, preparation, assessment, generalisation, debriefing, goals, actions, feedback, enjoyment and skill challenge. Although the full description of PGC is in D2.6, for completeness here we briefly describe each of the elements.

2.3.1 Prosocial Game Canvas

The Prosocial Game Canvas is shown in Figure 7.

![Prosocial Game Canvas](image)

- Outcomes: The overarching goal of the game, i.e the skills your target audience has to learn.
- Resources: The requirements your game has to meet, and the people, places, materials, and technology that you will have at your disposal.

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\(^5\) [http://www.businessmodelgeneration.com/canvas/bmc](http://www.businessmodelgeneration.com/canvas/bmc)

\(^6\) [http://files.thisisservicedesigntinking.com/tsdt_cujoca.pdf](http://files.thisisservicedesigntinking.com/tsdt_cujoca.pdf)
Audience: The interests, abilities, and (cultural) backgrounds of your target audience, collected during the research phase.

Inspiration: Existing games, scenarios, genres, and mechanics that you feel might fit or inspire your particular problem, collected during the research phase.

Assessment: The embedding of assessment in your game and/or its setup to see whether it delivers on its prosocial learning goals.

Preparation: A core component of teaching prosocial skills is to instruct and model the skill.

Debriefing: The most important part of learning with any game, debriefing entails reflective activities players engage in after (or during) gameplay.

Generalizing: Extending the debriefing for the players to reflect on and draw lessons from what they have done in the game and how it relates to actions in real life.

Skill challenge: The central challenge that makes reaching the game’s goals hard – which in a prosocial game is the central prosocial skill that the player tries to learn.

Goals: The win states of the game.

Actions: What players do to reach their goals.

Feedback: How the game tells the players how well they are doing in achieving their goals.

Enjoyment: The particular kind of positive emotion or ‘fun’ that your game aims for.

2.3.2 Prosocial game model

As described in detail in D2.6, learning prosocial skills through a digital games based approach requires supporting the learner beyond providing just a game. The approach requires firm and explicit grounding of the players in the real world about the skills they are going to be practicing. This is required both prior to playing the game, as part of preparation, and after playing the game as part of debriefing and generalisation. The significance of the player’s experience must then be further enhanced through real world rewards, as fit for the specific situation.

Here we present the Prosocial Skill Game Model (PSGM), drawing on the PGC, the model encompasses activities both within (“in-game”) and outside of (before and after) the game. Critically the model describes the flow resulting from Player Action which through Evaluation (or assessment of actions) which is moderated by Context results in Outcomes. Outcomes encompass both in-game rewards and feedback and additionally may influence Real World Rewards.
Elements of the Prosocial Skill Game Model

Table 1 describes the individual elements of the Prosocial Skill Game Model.

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
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<tbody>
<tr>
<td>Preparation</td>
<td>The responsibility and material that provides instructions and the knowhow needed about the skill. Items for consideration includes both who (a teacher, parent, student, the game software, etc.) will present the knowledge, and what, the content or demonstrations are needed.</td>
</tr>
<tr>
<td>Assessment</td>
<td>Providing a baseline measure of the target audience’s skill and a target measure of what to aim for. This generally occurs outside of the game, however in some instances the game developer may incorporate it into their game.</td>
</tr>
<tr>
<td>Player Action</td>
<td>The action carried out in game that signifies the demonstration of the skill. This also includes not carrying out the skill at a time that would be expected according to the game design, or conversely demonstrating the opposite of the skill.</td>
</tr>
<tr>
<td>Evaluation</td>
<td>The process of evaluating the player’s action in order to derive a set of outcomes, taking into account the context under which the action is carried out by the player.</td>
</tr>
<tr>
<td>Context</td>
<td>The elements that give specific meaning to the player’s action in the specific game. This includes the game narrative, the relationship between the player and entities it’s interacting with, the game dynamics and the player’s history.</td>
</tr>
<tr>
<td>Outcomes</td>
<td>The outcomes concern primarily in-game outcomes such as feedback and rewards. However outcomes can also influence real world rewards.</td>
</tr>
<tr>
<td>Debriefing</td>
<td>Debriefing extends feedback to the player about their actions and impacts in the game, often occurring at the end and/or immediately after playing the game.</td>
</tr>
<tr>
<td>Generalisation</td>
<td>Helps the player be able to use the skill in the real world. Players identify where and when to use the skill and how to apply it to a variety of circumstances. Generalisation can be done in-class and as homework.</td>
</tr>
<tr>
<td>Real World Rewards</td>
<td>Real world rewards are reinforcements given to the player outside the game and can be of material, social, activity or token types. See section 3.2.4.1 of D2.6 for full detail.</td>
</tr>
</tbody>
</table>

Table 1 Individual elements of the Prosocial Skill Game Model
### 3 Prosocial World Data Model

This chapter provides the prosocial world data model which operationalizes the conceptual Prosocial Skill Game Model. All the elements and attributes required by the game have been described, these elements define the interactions required to help players improve their prosocial skills. The prosocial world data model operationalizes the conceptual Prosocial Skill Game Model (PSGM). It contains the functional and attributes the game requires in order to define the interactions required to help players improve their prosocial skills. Elements such as assessment and generalization are beyond the scope of the world data model and are not included. Table 2 provides a description of the main elements of the prosocial world data model.

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Player</strong></td>
<td>The individual playing a prosocial game on the PSL platform.</td>
</tr>
<tr>
<td><strong>NPC</strong></td>
<td>A Non-player character in the game capable of carrying out Actions and displaying Emotions and Engagement.</td>
</tr>
<tr>
<td><strong>Group</strong></td>
<td>A collection of players and/or NPCs. Group members may associate with each other cooperatively or competitively, and/or compete or cooperate with other groups.</td>
</tr>
<tr>
<td><strong>Game Master</strong></td>
<td>Individuals who have special controls to manipulate the game and other players’ abilities, Outcomes or Resources. For example, a teacher delivering a lesson to teach social skills based on a prosocial game.</td>
</tr>
<tr>
<td><strong>Skill</strong></td>
<td>The description of desired prosocial learning objective.</td>
</tr>
<tr>
<td><strong>Action</strong></td>
<td>The demonstration of a Skill by the player or NPC through actions in the game.</td>
</tr>
<tr>
<td><strong>Outcomes</strong></td>
<td>Rewards, Feedback and Achievements resulting from Player Action.</td>
</tr>
<tr>
<td><strong>Resource</strong></td>
<td>Derived or related to in-game commodities such as energy, health, magic or functional abilities or information etc.</td>
</tr>
<tr>
<td><strong>Narrative</strong></td>
<td>The what, why and how. The story or narrative that gives meaning to why an Action is important and what Outcomes it may represent.</td>
</tr>
<tr>
<td><strong>Evaluation</strong></td>
<td>Uses Context and player Action to calculate Outcomes.</td>
</tr>
<tr>
<td><strong>Context</strong></td>
<td>All the elements that impact the Evaluation of an Outcome including the relationship between players, Action target and Narrative.</td>
</tr>
</tbody>
</table>

**Table 2 Main elements of the prosocial world data model**

The diagram below provides the overview of the constituent elements of the world data model together with high level relationships between the elements.
3.1 Model details

In this section we describe in detail the constituent elements of the Prosocial World Data Model.

3.1.1 Player

Defines the individual playing a prosocial game on the PSL platform and their social graph.

**Action History:** Log of the player’s previously performed actions, for example temporal (time stamp) and spatial (where in the game), the action has been carried out by the player. The frequency of a particular action is used to determine the sufficiency of a skill.

**Social Graph:** Relationship of player to other players. May incorporate visualization of the player’s behavior towards other players. Useful to teachers and the game designer to implement adaptive gameplay.
Role: The role of the player in the game or particular action. For example, this may simply be ‘giver’ and ‘receiver’ or can be used to specify more complex roles such as ‘leaders’ and ‘followers’. This will be context dependent, as in ‘Player->performedAction->withObject->inRole’.

Emotion: State of the player’s emotions as measured by sensors.

Engagement: Level of engagement of player as measured by sensors or through in-game analytics.

Skill(s): List of skills which can be demonstrated by the player.

3.1.2 NPC
Defines a Non-player character in the game capable of carrying out Actions and displaying Emotions.

Emotional State: Non-player characters have the capacity to have emotions which are affected by the emotional modifier values inside Outcome objects.

Engagement: Level of NPC engagement through as set in game.

Action(s): Actions that the NPC performs which can trigger associated skills.

Skill(s): List of skills which can be demonstrated by the NPC.

3.1.3 Group
A collection of players and/or NPCs. Group members may associate with each other cooperatively or competitively, and/or compete or cooperate with other groups.

Interdependence: Determines whether the members of the group are working together or against each other or neither.

Members: The players belonging to the group.

Resources: Resources shared by the members of the group.

Outcome/Rewards: Rewards applied to all members within the group.

Outcome/Feedback: Feedback applied to all members inside the group.

3.1.4 Game Master (GM)
This is a role an individual (for example a teacher) can have which provides special controls to manipulate the game and other players’ abilities, Rewards or Resources.

View(s): The game master or teacher will be able to view game elements that the players cannot see. These will range from general overviews and stats to specific mechanics and interactions. Spectator mode.

Interventions: Situations may arise where the teacher will want to change the game to move players towards learning goals. These model aspects may be altered by the GM at their own discretion.

Narrative: The story of the game’s context. An example of altering this would be to skip or repeat game scenarios.

Outcome: Rewards, Feedback or Achievement given to players by the GM.
**Resource:** Resources given to players by the GM outside the game mechanics.

**Interdependence:** The GM can change the alignment of players to mix up team compositions or turn competitors into teammates.

**Group/World Social Graph:** A representation of the relationships between all the players participating in the game or specific groups.

### 3.1.5 Skill

The complete description of demonstrable prosocial *Actions* by a player or NPCs in the game.

**Name:** Name of the skill

**Description:** Complete information and knowhow on the skill, including:

- **Category:** Skill category such as Friendship, Feelings or Cooperation as suggested in D2.6 - or from another taxonomy such as CASEL.
- **Why:** Why the skill is important and how it promotes positive outcomes.
- **When:** What situations is it necessary and where it may be inappropriate.
- **How:** Detailed steps-by-step guide on how to perform the skill.
- **Related:** Associated skills, including prerequisites skills and those which may be implementing alongside.
- **Generalisation:** Reflection questions and homework exercises the player can engage to support learning the skill.
- **Implementation:** In-game actions, mechanics, narrative and contexts which may need to exist to give the player the potential to demonstrate the skill.
- **State:** The state of the skill for the player, whether it is active or not. The level may be set dynamically by the game designer and may be possible to be changed through the platform. The possible states of a skill are also tracked along **Sufficiency:**
  - *Performed:* The player has performed the action of demonstrating the skill.
    - *Excessive:* The player has performed the action too much.
    - *Sufficient:* The player has performed the action just right.
    - *Insufficient:* The player has performed the action but not sufficiently.
  - *Not performed:* The player has not performed the action (at the time it was required).
  - *Performing the Opposite/Displaying The Opposite Skill:* The player has demonstrated the opposite skill.

States are altered through *Player Action*, which through *Context* modulate *Outcomes*.

### 3.1.6 Action

The demonstration of a *Skill* by the player or NPC in the game.
Skill(s): The skills triggered by the action performed. Player Actions are evaluated to Outcomes as modulated by Context.

3.1.7 Outcome

Rewards, Feedback and Achievements resulting from Player Action. Describes the outputs resulting from Player Actions. There can be multiple Outcomes resulting from an individual action and include Feedback, Rewards, Achievements and Real World Rewards. Outcomes are dependent on State and Context.

Timing: Outcomes may be presented immediately after the Player Action or presented at the end of the game or session.

Target: Specifies to whom the Outcomes apply – for example Feedback may be provided to the player performing the action or the player receiving the action or to the group.

Dispenser: The entity which provides the outcome to the player.

Game System: The game provides the outcome.

Other players: Other players provide the outcome.

Teacher / Game Master: Outcomes initiated by teacher or game masters.

Self: The player has the opportunity to reward themselves.

Type: Describes the types of outcome are provided, i.e. Feedback, Rewards, Achievements and Real World Rewards.

Feedback: Textual response to Player Actions.

Reward: Rewards are positive reinforcements given to the player for the purpose of encouragement and to signify the correct display of skills in the game.

Reward Type: There are a range of different reward type, which includes Social, Material, Activity or Token based. These types of reward also depend on whether the reward is being applied within or outside of the game. The chart below shows a few examples of the different types of reward in their in-game and out of game states, see D2.6 section 3.2.4.1 for a fuller list.

<table>
<thead>
<tr>
<th>Reward Type</th>
<th>In-game</th>
<th>Out of Game</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social</td>
<td>Leaderboards, gifting, achievements</td>
<td>Smiling, applause, medals, high fives, verbal “you did a great job on…“</td>
</tr>
<tr>
<td>Token</td>
<td>Points, in-game currency</td>
<td>Classroom points</td>
</tr>
<tr>
<td>Material</td>
<td>Item, ability</td>
<td>Food, stickers, letter of praise, badge</td>
</tr>
<tr>
<td>Activity</td>
<td>Bonus level, extra play time</td>
<td>Read a comic, play another game (classroom or digital)</td>
</tr>
</tbody>
</table>

Quantity/Element: The amount/ level or item awarded to the receiver.
Achievement: Achievements are tied to feedback, though not every piece of feedback has an associated achievement. Achievements are commonly used when a player has sufficiently displayed a particular skill. For example, a player demonstrating a good level of the ‘Saying Thank You’ skill will receive the ‘Gratitude Achievement’.

3.1.8 Resource

Derived or related to in-game commodities such as energy, health, magic or functional abilities or information etc.

Type: The resource may be a special ability or exclusive action for the receiver to perform, information about a game aspect or numeric quantities (such as cash and upgrade points) which are more typical resource types.

Quantity: The number of the type of resources. Can be infinite or finite. For the information and ability types this number may simply be 1 or may represent the number of uses the ability has left.

Interdependence: This denotes whether the resource supply is competitive, cooperative or neutral. In resource terms these mean the resource is exclusive to the owner, sharable or of infinite supply, respectively.

3.1.9 Narrative

Relevant details of the in-game narrative to help determine an action’s outcome. The narrative is not currently imagined as machine readable storyboard, rather text to provide context for teachers etc. Narrative contains one or more of the following elements:

NPC(s): Non-player characters involved in the narrative.

Skill(s): The focus of what the narrative is trying to teach.

Story/Plot: Backstory to the narrative.

Context: What is happening at the current point of the story.

Content: Why is the current narrative important.

Delivery: How the content is delivered to the players.

3.1.10 Evaluation

Uses Context and player Action to calculate Outcomes.

3.1.11 Context

Contains the relevant circumstances that from the setting for a Player Action in the game, this includes Relationships, Concern Matrix,

Relationship: Describes who the player is performing the skill to or with. The relationship can be one of the following:

Self: The player is demonstrating the skill to themselves, such as self-control

Other: The player is interacting with a singular identity, such as a player or NPC

Others: The player is demonstrating the skill within a group of players or NPCs
**Concern Matrix:** The Concern Matrix provides a position and vector that places the *Player’s Action* with respect to the player’s concern for themselves against the player’s concern for the other. The matrix is built on earlier works by Thomas-Kilmann model. (Thomas 1974) See Figure 10 below:

![Concern Matrix Diagram](image)

**Figure 10 Concern Matrix**

The data in the outcome indicates the player’s current and previous positions and the vectors between them. Depending on the nature of the game, the target or aim is to have the player’s concern value in a particular area of the graph. This information may be made available to the teacher and can be used by the developer to adapt the game.

**Interdependence:** Describes the relationship between the entities within the *Relationship* value as competitor, teammate or neutral.

**Sufficiency:** Determines whether a Player Action that represents a Skill being performed excessively, insufficiently or just right, given the *Context.*
4 Game Mechanics in Prosocial Games

In this section we provide a range of prosocial game mechanics built on and extending common game patterns found in the leisure gaming industry including reward and feedback systems, trade, alliance and unfolding narrative. The methodology and process described can be applied to a wide variety of other game mechanics, depending on the interests of game developers.

Game mechanics are defined at an abstract layer and the potential ways in which they can operate on the Prosocial World Data Model are exemplified with reference to a sampling of the prosocial skills as defined in D2.1 and D2.6.

The mechanics of reward and feedback system includes the specific method which can be used for adaptation of points, corrective feedback and provide constraints such that they can be used to design prosocial situations which can respond to players actions in different contexts. The generalized Prosocial World Data Model is reflected in the game mechanics, with adaptation methods primarily dependent on the game designer and facilitated through the reward and feedback systems.

4.1 Reward and Feedback Systems

Reward and Feedback system describes the structure and method in which the timing and amount of in-game incentives and corrective feedback are determined. As described in detail in D2.6 section 3.2.4 the key factors in designing reward and feedback systems to teach prosocial skills differs from general leisure game reward systems.

In particular whilst in leisure games, game designers tend to liberally use negative rewards and punishment, when attempting to teach prosocial skills the use of punishment is strictly prohibited. As the saying goes ‘you can’t teach compassion through punishment’, attempting to teach a specific prosocial skills by punishing the player will not result in the player associating the skill in a positive light generally. Additionally positive rewards must be proportional and context appropriate. A reward system must take into consideration the contingency, immediacy, consistency, frequency, amount and variety of reward in response to the context in which the player is performing or demonstrating a specific prosocial skill.

As noted in D2.6 when first trying to establish a new appropriate behaviour almost all instance of that behaviour ought to be rewarded. This high frequency of reinforcement is necessary to establish the behaviour, once it seems clear that the behaviour has actually be acquired, the reinforcement schedule can decrease.

The general use of the term ‘feedback’ often refers to both positive reinforcement and corrective feedback, however, for the purposes of the reward and feedback system described here, feedback represents ‘corrective feedback’; Whereas corrective feedback is specific instructions to the players to correct their behavior. This corrective feedback as described in detail in D2.6 section 3.2.4 is necessary to support players in learning prosocial skills, however it’s frequency must be tempered, such that the ratio of positive reinforcement to corrective feedback is approximately 5:1. The ratio of 5:1 is a general rule and should be monitored and modified as needed.(Reddy 2012)

The feedback system, in its simplest form, provides textual corrective feedback to the player after a threshold number of actions have been made. This system builds on the reward system by taking into account the context and frequency of player demonstrating a particular prosocial skill.
In order to describe the reward system we use Machination. Machinations (Dormans 2009, Adams and Dorman 2012) is an interactive framework for dynamic graphical representation of game mechanisms. It is a tool that helps describe games as dynamic systems and focuses on closed feedback loops within them.

The key shown in Table 3 will help interpret the diagrams in the following section.

<table>
<thead>
<tr>
<th>Machinations diagram reference</th>
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<tbody>
<tr>
<td><strong>Node</strong></td>
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<tr>
<td><img src="source.png" alt="Source" /></td>
</tr>
<tr>
<td><img src="resourceconnector.png" alt="Resource Connector" /></td>
</tr>
<tr>
<td><img src="resourcepool.png" alt="Resource Pool" /></td>
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<tr>
<td><img src="converter.png" alt="Converter" /></td>
</tr>
<tr>
<td><img src="statemodifier.png" alt="State Modifier" /></td>
</tr>
<tr>
<td><img src="sink.png" alt="Sink" /></td>
</tr>
</tbody>
</table>

Table 3 Machinations diagram reference

Figure 11 below describes a system for determining the level, quantity and frequency of a player receiving a reward (positive reinforcement) and feedback (corrective feedback) depending on whether they demonstrate a prosocial skill ‘too little’, ‘just right’, ‘too much’ or demonstrating the ‘opposite’. These factors are moderated by context, which includes the player’s previous actions and attempts. For example a player who constantly displays a particular skill will gradually receive a reduced level of reward for that skill. Conversely if a player has not been performing a particular skill often enough or at all, they will receive a proportionally higher reward as soon as they demonstrate the specific skill.

The playable version of the model below can be found at [http://playgen.com/prosocialmodel](http://playgen.com/prosocialmodel)
There are four inputs into the system which represent how well a skill is being displayed; **Just Right** (1a), **Too Much** (1b), **Too Little** (1c) and **Opposite/Incorrect** (1d).

The Just Right (1a) action triggers the Positive (2c) gate, and the rest trigger the Negative (2a) gate. This second layer of gates filters actions into whether they displayed the measured skills or not.

The system works with buckets being filled with credits. When a bucket reaches its threshold, it empties and triggers a reward or a feedback depending on the bucket.

If a Positive action (2c) is taken, it fills the Reward Bucket (3b) with Reward Credits (3a) based on the current Credit Rate (2b).

The Credit Rate (2b) is decreased the more Positive actions (2c) are taken, and conversely increased when Negative actions (2a) are taken. This represents the player not being excessively rewarded if they are already displaying skills and being greatly rewarded if displaying the skill for the first time out of many incorrect attempts, respectively.
When the Reward Bucket’s (3b) contents meet the threshold, the bucket empties and increments the Total Rewards (4) count (the amount of which it is being incremented by corresponds to the size of the reward).

The Corrective Feedback part of the system has separate Excessive (6a), Insufficient (6b) and Incorrect buckets (6c). Now when a player triggers a Negative action (2a), it will add Feedback Credits (5) to the appropriate bucket.

In the case of Excessive (6a) and Insufficient (6b) buckets, to represent the sliding nature of the player’s position on the sufficiency scale when performing an action, the buckets will draw credits from each other, if able.

Performing the Incorrect action (1d) will drain credits from the Excessive (6a) and Insufficient (6b) buckets, which moves the player closer towards receiving feedback about doing the wrong action rather than an incorrect frequency of the right action. Performing the action Just Right (1a) will drain credits from each of the feedback buckets.

When a feedback check reaches its threshold, it drains credits from the related bucket to produce a feedback of the correct type.

In the following sections game mechanics utilise the Prosocial World Data Model defined in chapter 3, to give examples of how a developer may implement the model into a game. In each instance we’ve selected a game mechanic and then applied it to one or more prosocial skills. It is up to the game developer to use their creativity in applying game mechanics to skills, as detailed in D2.6, game mechanics that contain player to player interaction are most aptly suited for teaching prosocial skills. In the examples below we cover the mechanics of trade,

4.2 Trade

A trade is an exchange of some kind of resource between entities including players and NPCs. When implementing the mechanic, there needs to be reasons for players to want to own the resource and why they should wish to exchange with others. The game may allow some level of dialogue for bartering and an interface for finalizing trades officially. The trade mechanic can be used to demonstrate prosocial skills. Such skills include Being Assertive and Saying No.

4.3 Conflict
In conflict, two or more parties, often players or players against the game system, have goals, what cannot be satisfied together. i.e. a zero-sum situation between two entities, most commonly over resources, goals or actions.

Whilst conflict appears in many games determining the nature of the conflict in relation to the prosocial skill being taught is critical for the game designer. For conflict to exist, players must be aware that they have opponents, or have some information about the goals of other players. Conflict resolution in a prosocial framework must provide the opportunity for players to find win-win or compromise situations. In general a conflict situation that would lead to a player acting selfishly in order to be successful must be avoided.

Trade/Conflict Examples:

Using the Prosocial World Data Model, the examples below run through a potential implementation of Trade/Conflict Resolution mechanisms. The hypothetical game involves a pair of players starting with a distinct resource type, who must trade with each other so that they have a number of each resource. The available actions to each player are proposing, accepting or rejecting a trade.

4.3.1 Using Trade with Skill of Being Assertive - Performing Sufficiently

In this example we utilize the game mechanic of trade in teaching the skill of being assertive in a situation where the player is sufficiently performing the skill, i.e. they are showing just the right amount of assertiveness, not being too assertive or too submissive.

Skill: Being Assertive

- **Description:** Calmly standing up for your or other’s points of view.
- **Category:** Cooperation Skills
- **Why:** Children who use effective assertive strategies affectively, without being too assertive, are more likely to successfully resolve conflicts with others.
- **When:** Your friend takes a ball that you were playing with. Your sister or brother pushes you. A child in your class begins coloring on your paper.
- **How:** 1. Decide if something is bothering you. 2. Think about how to tell the person how you feel. 3. Share your feelings with the person. 4. Suggest to the person another (alternate) behaviour that is acceptable.
- **Related:** Saying no, taking turns, shared resources, solving a problem as a group, cooperation, negotiating.
- **Generalisation:** Homework: 1. What Happened? 2. How did you do on scale from one to five, five being the best? 3. Why did you give yourself this score?

- **Implementation:** Transferal of ownership, proposing/accepting/rejecting offers, trade, bartering, dialogue options, shared resources, negotiation.

**Context:** The player demonstrated assertiveness when their competitor (another player) made an unreasonable trade request.

- **Relationship:** The relationship between the current player and who they are trading with, Other

- **Concern Matrix:** Compromise (in this context the other player is being selfish, so the correct outcome is to reach a compromise)

- **Interdependence:** Every pair of traders are considered competitors. Competing on resources.

- **Narrative:** The narrative provides the basis for the player interaction.
  - **Skill(s):** Being assertive, saying no
  - **Context:** The other player has made an unreasonable trade request

- **Sufficiency:** Sufficient (player is being assertive and the amount of assertiveness is sufficient because the other player is being selfish)

**Outcome:** The player is awarded an Assertive Achievement for correctly demonstrating the skill.

- **Timing:** Immediate

- **Target:** Self

- **Dispenser:** Game System

- **Type:** Achievement
  - **Achievement:** Assertive Badge

### 4.3.2 Being Assertive - Performing Excessively

In this example we utilize the game mechanic of trade in teaching the skill of being assertive in a situation where the player is excessively performing the skill, i.e. they are showing to much assertiveness to the detriment of the other player.

**Context:** The player is being too assertive when making the trade and is pushing the other player into making an unfair trade.

- **Relationship:** The relationship between the current player and who they are trading with, Other

- **Concern Matrix:** Selfish (you are being too assertive about what you want you don’t care about what the other person wants)

- **Interdependence:** Every pair of traders are considered competitors.

- **Narrative:**
  - **Skill(s):** Being assertive, saying no
  - **Context:** The player is making a trade with another player

- **Sufficiency:** Excessive

**Outcome:** This triggers a textual feedback response in a later summary.

- **Timing:** Summative
- **Target**: Self
- **Dispenser**: Game System
- **Type**: Corrective Feedback
  - **Feedback**: ‘Thinking about what the other person wants and come to a fairer proposal.’

### 4.3.3 Saying No - Performing the Opposite

In this example we utilize the game mechanic of *trade* in teaching the skill of *saying no* in a situation where the player is *performing the opposite of* the skill, i.e. they are saying Yes where they should be saying no, thereby not showing sufficient concern for themselves.

**Skill**: Saying No

**Description**: Identify how and when to say No, in collaborative work, it is important to learn how and when to say no when you’re not happy with something

- **Category**: Cooperation Skills
- **Why**: Learning to say no can be useful when children face social situations such as adult requests, peer conflict and bullying.
- **When**: A friend pressures you to swap your items in the game for another item which is worth a lot less.
- **How**: 1. Decide whether or not you want to do what is being asked.
   Discuss when and with whom saying no is appropriate.
   2. Think about why you don’t want to do this.
   Discuss reasons for saying no: You may get into trouble, or you may have something else you want to do.
   3. Tell the person no in a friendly way. Practice saying no in a friendly but firm manner.
   4. Give your reason.
   Giving a reason may help the other person understand better.

- **Related**: Being assertive, taking turns, staying on task, negotiating, accepting no.
- **Generalisation**: Homework: Identify situations in School, at Home, in Peer Group or Community where you need to say no. Practice the skill: Write with whom you will try this and when, after you practice the skill write answers to the following questions ‘what happened?’, ‘how did you do?’, ‘why do you think that?’
- **Implementation**: Transferal of ownership, proposing/accepting/rejecting offers, trade, bartering, dialogue options, negotiation.

**Context**: The player’s competitor NPC is pushing them into an unfair deal and the player accepts it without saying no.

- **Relationship**: The relationship between the current player and who they are trading with, *Other*
- **Concern Matrix Outcome**: Selfless (you are caring too much about the other person)
- **Interdependence**: Every pair of traders are considered competitors.
**Narrative:**
- **NPC(s):** Trader
- **Skill(s):** Being assertive, saying no
- **Context:** The NPC is pushing an unfair trade request

**Outcome:** In this context, the player needed to be more selfish and received a textual feedback.
- **Timing:** Summative
- **Target:** Self
- **Dispenser:** Game System
- **Type:** Feedback
  - **Feedback:** ‘It’s okay to say no when you think that what you are being offered is unfair.’

### 4.4 Alliances

Alliances are a group of players who agree to follow specific rules of conduct towards each other and may have a shared agenda. Alliances are prosocial for they give players the opportunity to control who they team up with and when.

Games incorporating alliances should look for skills regarding friendship and cooperation, mainly. In particular: Cooperation, asking for help, helping others, solving a problem as a group, introducing self to others, introducing others, communicating with others, sharing your things with others.

The example game for this mechanic has the players competing against each other to defeat a more powerful common enemy NPC first. However, the players learn that none of them will have the capacity to overcome the NPC on their own. The available actions to players are making/breaking alliances and aiding the other players within the alliance by sharing resources.

#### 4.4.1 Introducing Self to Others - Performing Sufficiently

In this example we utilize the game mechanic of **alliance** in teaching the skill of **introducing self to others** in a situation where the player is **sufficiently performing** the skill, i.e. they are introducing themselves when needed.

**Skill:** Introducing Self To Others
- **Description:** Introducing Self to Others is a key basic skill in making and keeping friends.
  - **Category:** Friendship Skills
  - **Why:** Children use various communicative and interactive skills to establish friendships and forge peer acceptance.
- **When:** You have just joined a game and need to get to know others in the game so they can join your team and you can work together.

- **How:** 1. Walk toward the other player. 2. Wait until the other player acknowledges you. 3. Tell them your name. 4. Pause to see if they tell you their name, if they forget, ask their name. 5. Say it was nice to meet them.

- **Related:** Introducing other, joining a conversation, joining a playgroup, being assertive.

- **Generalisation:** Homework: Identify situations in School, in Peer Group or Community where you need to introduce yourself to others. Practice the skill: Write with whom you will try this and when, after you practice the skill write answers to the following questions ‘what happened?’; ‘how did you do?’; ‘why do you think that?’

- **Implementation:** Game to incorporate dialogue/chat options.

**Context:** The player clearly and confidently introduces themselves to their competitor and in turn forges an alliance. Alliances must be forged to continue.

- **Relationship:** The relationship between the player and who they are attempting to ally with, Other

- **Concern:** Win-Win

- **Interdependence:** The players are considered competitors at this point in time until an alliance is made.

- **Narrative:**
  - **Skill(s):** Introducing Self To Others
  - **Context:** The player is proposing an alliance to another player

- **Sufficiency:** Sufficient

**Outcome:** The outcome reward for the player is the alliance being accepted by the other player.

- **Timing:** Immediate

- **Target:** Self

- **Dispenser:** Other

- **Type:** Reward
  - **Reward Type:** Ability (Ally)

### 4.4.2 Helping Others - Not Performing

In this example we utilize the game mechanic of *alliance* in teaching the skill of *helping others* in a situation where the player is *not performing* the skill, i.e. they are not helping others as they ought to.

**Skill:** Helping Others

- **Description:**
  - **Category:** Cooperation skills
  - **Why:** Helping others is a powerful protective factor related to academic and social success in children.
- **When:** A classmate can’t reach his lunchbox, but you can. Your sister is having difficulties playing a new video game. Your classmate looks as though he is having trouble carrying all his books.

- **How:** 1. Decide what the problem is. 2. Decide if someone needs your help. 3. Ask your friend if you can help them. 4. If your friend says yes, then help them.

- **Related:** Asking for help, showing concern for other’s feelings,

- **Generalisation:** Homework: Identify situations in School, at Home, in Peer Group or Community where you need to help others. Practice the skill: Write with whom you will try this and when, after you practice the skill write answers to the following questions ‘what happened?’, ‘how did you do?’, ‘why do you think that?’

**Implementation:** Transferal of ownership, dialogue options.

**Context:** The player comes across an injured ally who is in need of help (e.g. health potion) but the player ignores the opportunity to assist.

- **Relationship:** The relationship between the player and their ally, Other

- **Concern:** Selfish (Player is being selfish by not helping others)

- **Interdependence:** The players are considered teammates as they are part of the same alliance

- **Narrative:**
  - **Skill(s):** Helping Others
  - **Context:** Another player is requesting the assistance of the player

**Outcome:** Here the other player provides the feedback in relation to the context, by asking for help.

- **Timing:** Immediate

- **Target:** Self

- **Dispenser:** Other

- **Type:** Feedback
  - **Feedback:** ‘Helping others when they need help, means when you need help they are more likely to help you.’

### 4.4.3 Cooperation - Not Performing

In this example we utilize the game mechanic of *alliance* in teaching the skill of *cooperation* in a situation where the player is *not performing* the skill, i.e. they are not cooperating with others as they ought to.

**Skill:** Cooperation

- **Description:** The action or process of working together to the same end.

- **Category:** Cooperation Skills

- **Why:** Cooperating with others is a skill that requires children to coordinate their behaviors with peers and work in partnerships with others to achieve a common goal.

- **When:** Your friend wants to play baseball, but first the two of you have to finish your homework together. You mom wants you and your brother to work together to
clean up the house. Your teacher has given the class an assignment to build a spaceship as a group.

- **How:** 1. Listen to what other people on your team say. 2. Think about what you want to say. 3. Decide what you want to say. 4. Tell them if you agree with what they said. 5. If you don’t agree with them tell them it’s a good idea but you want to do it another way. 6. Listen to what the rest of the team says. 7. Work together to come up with group ideas. 8. Perform the task as a team.

- **Related:** Solving a problem as a group.
- **Generalisation:** Homework: Identify situations in School, at Home, in Peer Group or Community where you needed to cooperate with others but did not. Practice the skill: Write when did this occur in the past, then write answers to the following questions ‘what happened?’ ‘how did you do?’ ‘why do you think that?’

- **Implementation:** Chat/dialogue options, voting system.

**Context:** The alliances are developed in discussing strategies within the team to help complete the group objective. Here, the player is being proactive in this, but they are not taking on the ideas of other teammates as much.

- **Relationship:** The relationship between the player and their allies, *Others*
- **Concern:** Selfish
- **Interdependence:** The players are considered teammates as they are part of the same alliance
- **Narrative:**
  - **Skill(s):** Cooperation skills
  - **Context:** Players are voting on whose strategy they believe is optimal
  - **Sufficiency:** Insufficient (player is not performing the skill sufficiently)

**Outcome:** An endgame report of the player’s performance informs them of the textual feedback.

- **Timing:** Summative
- **Target:** Self
- **Dispenser:** Game System
- **Type:** Feedback
  - **Feedback:** ‘Your allies may have really good ideas, try them out and you may be surprised! By not cooperating with your allies you run the risk of not reaching your goals.’

### 4.5 Unfolding Narrative
Games use narrative to give the players a sense of context in the form of a story. Narrative mechanics directly influence the story through player actions. Many prosocial skills can be taught through such mechanics as they give a much clearer image of NPC emotion. See also D2.2. The example bellow could be in a branching scenario game representing conversations with NPCs.

### 4.5.1 Dealing with another person’s angry feelings - Performing Sufficiently

In this example we utilize the game mechanic of unfolding narrative in teaching the skill of dealing with another person’s angry feelings in a situation where the player is sufficiently performing the skill, i.e. they are managing to effectively deal with another person’s angry feelings.

**Skill:** Dealing with another person’s angry feelings

- **Description:** Emotional regulation that includes both cognitive and behavioral coping strategies include the ability to express feelings in response to another’s anger, deflecting the anger toward another stimulus or activity or seeking social support form friends, family or other adults.
  - **Category:** Feelings Skills
  - **Why:** Coping with another person’s anger is related to how well one regulates their emotions, cognitions, and behavioral responses to the event.
  - **When:** Your friend is angry with you because you did not want to play with him. Your mom is upset because she told you to clean up your toys, but you forgot. Your classmate is angry because he got a bad grade on the homework assignment.
  - **How:** 1. Ask the person if she feels like talking about what is making them angry. 2. Think about what to do: a) Be a good listener. b) Ask if you can help. c) Come back later if they want space. 3. Do it.
  - **Related:** Being an active listener, dealing with your angry feelings, identifying feelings and emotions, showing concern for other’s feelings.
  - **Implementation:** Chat/dialogue options.

**Context:** The NPC in the story has just been the victim of a theft and is displaying signs of anger. The player calmly deals with the situation and helps the NPC by reassuring them.

- **Relationship:** The relationship between the player and the NPC, Other
- **Concern:** Selfless
- **Interdependence:** Neutral
- **Narrative:**
  - **NPC(s):** Victim
  - **Skill(s):** Dealing with another person’s angry feelings
  - **Story/Plot:** The NPC has just been the victim of a theft
  - **Context:** The player is having a conversation with the NPC

**Outcome:** The player receives the Concern award for their actions.
- **Timing:** Summative
- **Target:** Self
- **Dispenser:** Game System
- **Type:** Achievement
  - **Achievement(s):** Concern Award

### 4.5.2 Showing Concern for Other’s Feelings - Performing Excessive

In this example we utilize the game mechanic of *unfolding narrative* in teaching the skill of *showing concern for other’s feelings* in a situation where the player is *excessively performing* the skill i.e. they are showing too much concern for other’s feelings to the detriment of their own feelings.

**Skill:** Showing concern for other’s feelings

- **Description:**
  - **Category:** Feelings skills
  - **Why:** Children’s empathy and concern for others are related to advanced prosocial behaviors, such as helping others and asking others.
  - **When:** Your friend didn’t get a good grade on the spelling test and he looks upset. Your grandma is upset because she dropped a plate and it broke. Your friend went to the school nurse and looks like she is feeling sick.
  - **How:** 1. Look to see if a person is feeling a certain way. 2. Ask the person if she is feeling the way you think she may be feeling. 3. Wait for the person to answer. 4. Ask why she is feeling that way. 5. Show concern. 6. If they are feeling good, tell them you are happy for their mood. 7. If they are feeling bad, tell them you are sorry for that they are feeling that way.
  - **Related Skills:** Being an active listener, identifying feelings and emotions, dealing with another’s angry feelings.
  - **Generalisation:** Homework: Identify situations in School, at Home, in Peer Group or Community where you show too much concern for other’s feelings. Practice the skill: Write with whom you will try this and when, after you practice the skill write answers to the following questions ‘what happened?’, ‘how did you do?’, ‘why do you think that?’
  - **Implementation:** Chat/dialogue options.
Context: Similar to the previous context. However the player is interacting with an NPC to work out what the problem is, when it appears that the NPC is disinterested and does not wish to talk about the problem.

- **Relationship:** The relationship between the player and the NPC, Other
- **Concern:** Withdrawal
- **Interdependence:** Neutral
- **Narrative:**
  - **NPC(s):** Victim
  - **Skill(s):** Showing concern for other’s feelings
  - **Story/Plot:** The NPC has just been the victim of a theft
  - **Context:** The player is having a conversation with the NPC
- **Sufficiency:** Excessive

Outcome:

- **Timing:** Summative
- **Target:** Self
- **Dispenser:** Game System
- **Type:** Feedback
  - **Feedback:** ‘Sometimes people can’t explain their feelings and just need some space to get their thoughts in order. It’s good to check if someone is feeling a certain way, if they are feeling good tell them you are glad, if they are feeling bad tell them you are sorry for that they feel that way.’

### 4.5.3 Understanding Social Cues - Not Performing

In this example we utilize the game mechanic of *unfolding narrative* in teaching the skill of *understanding social cues* in a situation where the player is required to but is *not performing* the skill, i.e. they are not responding to social cues from others as they ought to.

**Skill Name:** Understanding social cues

- **Description:**
  - **Category:** Feelings
  - **Why:** Children learn to understand social cues by observing and monitoring interactions of others.
  - **When:** a friend is finding a maths problem hard and you help. Someone is alone in the playground and you invite them to join in your game. Some is smiling and you ask them what’s making them happy.
  - **How:** 1. Look at what the other person is doing 2. Watch their facial expressions 3. Watch their body movements 4. Decide if they want to talk or be alone 5. Make the decision.
  - **Related:** Being an active listener, identifying feelings and emotions, self-control, dealing with another’s angry feelings.
  - **Generalisation:** Homework: Identify situations in School, at Home, in Peer Group or Community where you need to better understand social cues. Practice the skill:
Write with whom you will try this and when, after you practice the skill write answers to the following questions ‘what happened?’, ‘how did you do?’, ‘why do you think that?’

- **Implementation**: Chat/dialogue options.

**Context**: The NPC is busy with an activity, which the player ignores by initiating a dialogue without waiting.

- **Relationship**: The relationship between the player and the NPC, Other
- **Concern**: Selfish
- **Interdependence**: Neutral
- **Narrative**:
  - **NPC(s)**: Shopkeeper
  - **Skill(s)**: Understanding social cues
  - **Story/Plot**: The NPC is working in his shop
  - **Context**: The player needs to start a conversation with the NPC

**Outcome**:

- **Timing**: Summative
- **Target**: Self
- **Dispenser**: Game System
- **Type**: Feedback
  - **Feedback**: ‘Try to be more patient when wanting to talk to people who are busy doing other things. Look at what the other person is doing and watch their facial expression and body movement, decide if they want to talk or need help.’

### 4.6 More game mechanics

The example game mechanics together with skills described in the previous section serve as a template for providing prosocial game mechanics. Below we cover a range of other game mechanics which lend themselves well to teaching prosocial skills including; shared resource, social dilemma, roleplay, conflict, mutual goals and cooperation.

#### 4.6.1 Shared Resource

Resources which can be accessed by some or all players, could be used in conjunction with *Social Dilemma* and *Cooperation* game mechanics.
The game must provide the shard resource mechanism and opportunities for players to practice and learn a range of prosocial skills such as taking turns and helping others by sharing your things with others.

4.6.1.1 Taking turns – Performing Sufficiently

In this example we utilize the game mechanic of shared resource to teach the skill taking turns in a situation where the player is sufficiently performing the skill, i.e. they are managing to organise taking turns within a group.

**Skill name:** Taking Turns

- **Category:** Collaboration/Cooperation
- **Why:** The ability take turns is a concrete example of cooperation and self-awareness that children will often be required to employ in real-world scenarios.
- **When:** You and your siblings share a single gaming console. Your friends are sharing food around the table and you are the last to be reached. Your teacher is asking your class to read their work and multiple people want to go first.
- **How:** 1. Ask everyone in the team which turn they would like. 2. If someone else wants the same turn as you, discuss both your motivations. 3. Negotiate and find a compromise you are both happy with. 4. Follow the turn order as discussed.
- **Related:** Solving a Problem as a Group, Following Directions, Cooperation, Being a good sport, Respecting Others
- **Generalisation:** Homework: Identify situations in School, in Peer Groups or Community, at home where you need to take turns. Practice the skill: Write with whom you will try this and when, after you practice the skill write answers to the following questions ‘what happened?’, ‘how did you do?’, ‘why do you think that?’
- **Implementation:** Ordering/ranking system, proposing/accepting/rejecting offers, bartering, dialogue options, shared resources, and negotiation.

**Context:** The player and their allies must, in turn, individually complete a task, where the position in the order of turns determines the quality of the reward. The player is able to proactively discuss and arrange an order with the group without being too selfless or selfish.

- **Relationship:** The player and their allies, Others
- **Concern Matrix:** Compromise (it is unlikely that each ally will get the best reward possible)
- **Interdependence:** The players are considered teammates as they are allies.
- **Narrative:**
  - **Skill(s):** Taking turns.
  - **Context:** The group must each complete a task in turn, where the order determines the quality of the reward.
- **Sufficiency:** Sufficient.

**Outcome:** The player is awarded a Taking Turns achievement for correctly demonstrating the skill.

- **Timing:** Immediate
- **Target:** Self
- **Dispenser:** Game System
Type: Achievement
- Achievement: Taking Turns Badge

4.6.1.2 Accepting No – Not performed

In this example we utilize the game mechanic of shared resource to teach the skill accepting no in a situation where the player is not performing the skill, i.e. they poorly manage to accept a ‘No’ response.

Skill name: Accepting No
- Category: Collaboration/Cooperation
- Why: Emotional awareness and regulation of one’s own negative feelings facing a ‘No’ response, as well as understanding the reasons for receiving a ‘No’ response in the first place, will allow children to make positive choices and actions moving forwards.
- When: Your parents tell you that you aren’t allowed a treat before dinner. Your teacher tells you that you are incorrect about an aspect of your schoolwork. Your friend tells you that they do not want to share their toys at the moment.
- How: 1. Ask the person why you received a ‘No’ response. 2. Listen to what they say. 3. Think about whether there are alternatives to what you want that doesn’t involve this person. 4. Accept their response and thank them regardless.
- Related: Dealing with Rejection, Being a good sport, Respecting Others, Being Patient
- Generalisation: Homework: Identify situations in School, at Home, in Peer Groups or Community where you received a ‘No’ response, and what you did afterwards. Practice the skill: Write when did this occur in the past, then write answers to the following questions ‘what happened?’, ‘how did you do?’, ‘why do you think that?’, ‘how did the other person feel?’
- Implementation: Dialogue options, shared resources, and proposing/accepting/rejecting offers.

Context: An ally has already taken a shared resource that the player would like, but they decline the offer to give it to the player.
- Relationship: The player and another player, Other
- Concern Matrix: Selfish (your reaction is not considerate to respecting the decisions of others)
- Interdependence: The players are considered teammates as they share a resource.
- Narrative:
  - Skill(s): Accepting No
  - Context: The player is responding poorly to a ‘No’ response from another player.

Outcome: In this context the game system provides feedback based on the player’s response.
- Timing: Summative
- Target: Self
- Dispenser: Game System
- Type: Feedback
Feedback: ‘Try to think about the needs and emotions of other people and why they have said ‘no’ in this context. Often a ‘no’ response is not your fault, and it is good to be considerate of their declining.’

4.6.1.3 Sharing your things with others – Performed excessively

In this example we utilize the game mechanic of shared resource to teach the skill sharing your things with others in a situation where the player is performing excessively, i.e. sharing too much to the detriment to themselves.

Skill name: Sharing your things with others

- **Category:** Collaboration/Cooperation
- **Why:** Sharing things with others builds trust relationships and fully integrates cooperation and reaching mutual goals.
- **When:** Your sibling would like to play with some of your toys. Your friend is interested in trying some of your lunch. Your classmate would like to borrow your stationary.
- **How:** 1. Listen to the other person’s request. 2. Think about why they want that item. 3. Think about how you would feel without that item. 4. A) Decide if you want to share your things with them. B) If you do, give them the item and tell them if you are concerned about the item C) If you do not want to share, tell the person no in a friendly way and give your reason.
- **Related:** Being assertive, saying no, helping others, communicating with others
- **Generalisation:** Homework: Identify situations in School, at Home, in Peer Groups or Community where you can share your things with others. Practice the skill: Write with whom will try this and when, after you practice the skill write answers to the following questions ‘what happened?’, ‘how did you do?’, ‘why do you think that?’
- **Implementation:** Proposing/accepting/rejecting offers, dialogue options, shared resources.

**Context:** An NPC ally is requesting a shared resource from the player that the player currently holds and values.

- **Relationship:** The player and an NPC, Other
- **Concern Matrix:** Selfless
- **Interdependence:** Neutral.
- **Narrative:**
  - **Skill(s):** Sharing your things with others
  - **Context:** The player is responding to a request for a resource from an ally.

- **Sufficiency:** Excessive.

**Outcome:** A textual response is given in a later endgame summary.

- **Timing:** Summative
- **Target:** Self
- **Dispenser:** Game System
- **Type:** Feedback
Feedback: ‘You are allowed to say no and decline to share your things with others sometimes. Other people should be respective of your wishes as you should be respective of theirs.’

4.6.2 Social Dilemma

Choices players need to make that either set their own individual gains against each other’s or against the gains of a social group they belong to.

Typical social dilemma games may include ‘the prisoner’s dilemma’ or ‘the tragedy of the commons’. When incorporating social dilemma game mechanics into a game actions must be designed that provide individualistic reward for the player but may have shared penalties to the other players or for the group as a whole. The dilemma may be either due to the chance of gaining more rewards than others or due to making other players not receiving the rewards they anticipated.

Social dilemmas touch upon a whole range of skills, both skills for feelings (such as Self-control, Identifying feelings and emotions (in yourself and others), Expressing feeling and emotions, Dealing with your angry feelings, Dealing with another person’s angry feelings, Dealing with rejection, Dealing with being left out) and skills for cooperation (like Being a good sport, Being assertive, Saying no, Accepting no) will be made relevant, to degrees set both by design in context and narrative, and as unfolding in-game with actual other players and NPCs, where the traits of these influence the set and relative weight of the skills addressed. Social dilemmas may operate on reward or use of resource and can be combined with alliances, cooperation and in competition.

4.6.3 Roleplay

Gameplay where players take on the goals and behaviors of other (often fictional) characters.
The play is centered on making decisions based on how these characters would take action in a given situation. Particular roles may have specific skills or abilities for the player which others may not have. The identification of the player with their character is critical, and skills for feelings should have relevance here. In this respect please see D2.6 section 3.2.3 on role play enhancers. In general the game needs to be providing choice, in either taking part in the role play or not, as well as the ability for the player to make a public commitment to the role and the player’s intentions, and to provide positive reinforcement for performing the role effectively and correctly.

Apart from acting out the role in itself, it is thus skills for cooperation that are needed, particularly Setting goals and obtaining them, Following directions, Staying on task and Working independently. Role-play and role-reversal allows the player to experience a particular situation from multiple points of view and can be used as an effective method for generalization.

4.6.3.1 Dealing with Boredom – Not Performing

In this example we utilize the game mechanic of role playing to teach the skill dealing with boredom in a situation where the not performing the skill, i.e. they poorly manage their emotions when bored.

Skill name: Dealing with boredom

- **Description:**
  - **Category:** Feelings
  - **Why:** There are going to be many situations where a child will feel bored, and acting in a positive manner in such a situation is respectful to those around them.
  - **When:** You are not entertained by your schoolwork and getting bored. Your parents are watching a television show you don’t like and you’re getting bored. You have to wait for the school bus for longer than you want to.
  - **How:** 1. Decide if you are bored in a situation. 2. Think about whether the boring activity is something you can and should change. 3. A) If so, think of other activities you can do which are entertaining and respectful to those around you. B) If not, then think about different ways in which you can approach the activity to have a fresh, entertaining perspective (e.g. make it into a game). 4. Do the new activity or take the new perspective.
  - **Related:** Paying attention, Staying on task, Self-control, Respecting Others
  - **Generalisation:** Homework: Identify situations in School, at Home, in Peer Groups or Community where you are bored, and ways in which you can approach the situation to stop being bored. Practice the skill: Write when did this occur in the past, then write answers to the following questions ‘What caused you to bored?’, ‘what did you do?’, ‘how did that affect those around you?’.
  - **Implementation:** Multiple activity choices, dialogue options.

**Context:** The player is given a role to play in a group scenario, but they find the role boring and don’t perform as requested.

- **Relationship:** The player is interacting with other players during a role play scenario, Others
- **Concern Matrix:** Withdrawal
- **Interdependence:** Neutral
- **Narrative:**
  - **Skill(s):** Dealing with boredom
  - **Context:** The player is bored of a role and not performing as requested

**Outcome:** When the player stops performing the role as requested, the game will provide immediate feedback and advice.

- **Timing:** Immediate
- **Target:** Self
- **Dispenser:** Game System
- **Type:** Feedback
  - Feedback: ‘It is okay to feel bored, but think about how your actions affect those around you if you don’t play the role as requested. Try thinking of different ways of thinking about doing the role to entertain yourself, like approaching your tasks like little games in themselves.’

### 4.6.4 Mutual Goals and Team Play

Players in a group or a team must coordinate their actions, abilities, and roles in order to reach a common goal. Mutual goals and team play can be either between players in a multiplayer game or between the player and other NPCs that are under the player’s control.

The rewards for reaching the mutual goal of the team are often shared rewards and the corrective feedback for failure are often shared group feedback. It is possible to construct team play and mutual goals such that players distribute the reward and feedback between each other. Players who perceive the other players to not be acting prosocially, or in their best interest may hinder team performance. In shaping the use of mutual goals and team play in teaching prosocial skills it’s important that privileges or rewards gained through team play are explicit and deviation from demonstrating prosocial skills reduces the overall chance of success.
4.6.5 Collaborative Action

Players work together through collaborative action, where each player may have a specific roles or actions that can only be done by them and not by other players i.e., coordinate their actions and share resources, in order to reach the goals of the game. There is a lot of overlap between collaborative action and mutual goals and team play, however the distinction lies in the exact way in which the roles are so specific that only one player could fulfill a role, as in the picture above, whilst one person rows the boat, the other operates the rudder.

The design of collaborative action requires careful balancing of the actions in the game such that players actions are complimentary. When designing collaborative actions in games, how much coordination is required between the players and how the outcome of the action is based on the precision and type of coordination as well as how the possible rewards are shared need to be considered. Collaborative action can be achieved by requiring two or more actions to be performed simultaneously or by requiring several specific complimentary in-game abilities to perform different actions.

4.7 Summary

In this section we defined and operationalized a generalized model for positive reinforcement (reward) and corrective feedback designed for teaching prosocial skills. This model can be used as part of the adaptation mechanism and is applicable across the range of prosocial skills as part of the PGSM.

Additionally we exemplified game mechanics of trade, alliance and unfolding narrative, for teaching a variety of skills including being assertive, saying no, introducing yourself to others, helping others, cooperation, dealing with other’s angry feelings, showing concern for other’s feeling and understanding social cues. The examples serve to provide tangible instances of how game mechanics can be used to teach prosocial skills. The complete lists of prosocial skills are covered in D2.6 and D2.1.

We also provided overview of a range of other game mechanics which lend themselves well to being used in games to teach prosocial skills including shared resources, social dilemma, role-play, conflict, mutual goals and collaborative action.
5 Conclusions

This deliverable has provided an abstract model for developing games that teach prosocial skills, covering a variety of prosocial situations concerning player actions, context, evaluation and outcomes. It has provided a first attempt at the Prosocial World Data Model together with associated persistence mechanism provided by the platform.

A range of game mechanics including reward, feedback, trade, alliance and narrative have been described and modeled into examples intended to produce game play that leads to increased proficiency in prosocial skills. The rules that govern reward and feedback have been included to provide adaptation points and constraints so they can be personalised in response to the context for the specific players and evolving world situations. Additionally a range of game mechanics including shared resource, social dilemma, roleplay, conflict, mutual goals and collaborative action are described. These game mechanics can be used effectively for teaching prosocial skills.

Whist building on the effort in WP2, WP3 and WP4, the prosocial world data model lays the foundation for the game tracked attributes of Prosocial API, which will be developed further in Task 4.3 and presented in D4.4. Additionally the work further supports development of the adaptation manager in WP4 and in providing prosocial game mechanics intended for consumption in the games developed in WP6.
6 References


