Assignment 2 - Game Analysis using Machinations and i*

Group 21

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1 Introduction

For this assignment the two games Catan and No Thanks! are analysed and compared, answering the following questions:

- RQ1: What design structures are used to keep players engaged with the game, both regarding interest and regarding actively doing actions?
- RQ2: What design structures are used to make the games typically end near the stated time (given players that know the rules)?
- RQ3: What design structures are used to make players interact with each other, or at least have a feeling that they have been playing a game together?
- RQ4: What design structures exist to make players feel that they are achieving something while they are playing?

For describing and analysis the games we make use of the MDA model, game mechanics, gameplay design patterns and models of both games in i* and Machinations.

2 Definitions

2.1 Concepts & Tools

2.1.1 Mechanics

For this assignment we found Järvinen's (2008) definition of mechanics[1] quite useful. The best way of understanding mechanics as methods is to formalize them as verbs, with other syntactical/structural elements, such as rules, having influence on how those verbs act in the game. Mechanics mentioned in the assignment will be marked as *mechanic*.

2.1.2 Patterns

A pattern describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice. Gameplay design patterns will be used according to this definition from Staffan Björk, Sus Lundgren and Jussi Holopainen[2] and will be marked as **Pattern**.

2.1.3 Creative Leaf

Creative Leaf is a tool for creating i* models. For the i* models in this assignment we used the UK version[3] of Creative Leaf.

2.1.4 Machinations

Machinations[4] is a game design tool to model and simulate game systems. For this assignment we created Machinations models with the discontinued desktop version for Windows[5], as we did not have access to the browser-based platform's closed beta, when we created the models.

2.2 Gameplay Design Patterns

Runs
A **Run** is a **Set**[6] of game elements, which have values attached to them, with every element's value varying the smallest possible amount from another element's value.
Examples
Straight in Poker.
Using the pattern
Runs are commonly used to assign a special value to specific **Sets**[6], usually used to determine a **Score**[7].
Relations
Can Instantiate: **Gain Ownership**[8]
Can Modulate: **Sets**[6], **Game Items**[9], **Hands**[10]
Can Be Instantiated By: **Cards**[11], **Tiles**[12]
Can Be Modulated By: **Arithmetic Progression**[13], **Geometric Progression**[14]
Possibly Conflicting With: -

Trading
Trading is an activity where a player exchanges **Resources**[15] with other players or **Agents**[16] of that game.
Examples
Trading **Resources**[15] with other Players or Bank in Catan.
Trading goods in Civilization.
Using the pattern
Trading is usually integrated with games involving Resource Management as an **Aid to the Players**[17] lagging or in search of a particular **Resource**[15] or **Game item**[9]. In order to initiate

Trading both parties agree upon the specific item and the quantity of it to be exchanged with each other.
Relations
Can Instantiate: **Betting**[18], **Extra-Game Actions**[19], **Memorabilia**[20]
Can Modulate: **Gain Ownership**[8]
Can be Instantiated by: **Character Development**[21], **Heterogeneous Game Element Ownership**[22], **Player-Artifact Proximity**[23], **Player Created Game Elements**[24], **Purchasable Game Advantages**[25]
Can be Modulated by: **Game Element Insertion**[26], **Secondary Interface Screens**[27]

3 Game Description

3.1 Settlers of Catan

The Settlers of Catan is a **Turn Based**[28] **Multiplayer**[29] board game intended for at least 2 players. In the game, the players compete against each other to expand their Colony. The components used during gameplay of Catan are illustrated in the figure 1 below.

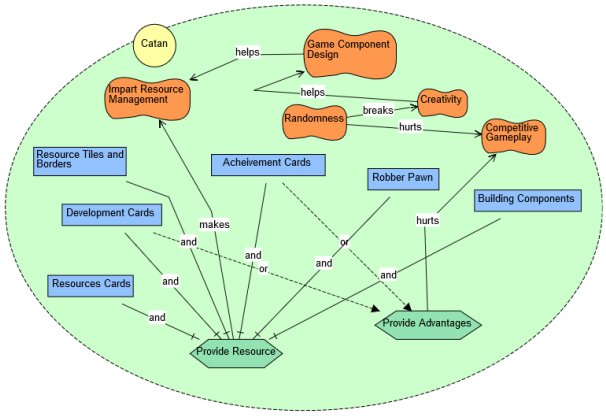


Figure 1: **Game items** of Catan

The main goal of the player is to **Score**[7] ten points. Analyzing the mechanical aspect[1], before gameplay initiates players are provided with two roads to be *placed* on any side of the hexagon **Tile**[12] and two settlements to be placed at any corners. However, once an initiation point has been determined, the successive roads, cities an settlements must be connected upon that. Also there must be at least two roads situated on the Tile connecting to a corner where the player wishes to construct a city or settlement. This helps the player achieve his goal of expanding his colony which in turn ultimately helps him in increasing his **Score**[7]. During each turn the Player can either *retrieve* **Resources**[15], *trade* **Resources**[15], create and expand their colony by *placing building components* or *play the Development card*. To commence gameplay, the two **Dices**[30] are *rolled*. The result of the roll is used to distinguish the **Tile**[12] from where the players, who have placed their colony adjacent to the Tile can retrieve **Resources**[15] in the form of the Resource Card. If the

number seven is rolled by a player, they get to *move the robber* from the desert to any of the other Resources Hexagonal **Tile**[12], restricting the other players to collect **Resources**[15] from there. If required during their turn players can ***trade*** *their* ***Resources****[15] with other players* or ***trade*** *the Deck* to replenish their stockpile. An individual pawn known as the robber, is also used as **Token Placement**[31] on the Hexagonal Tiles. The goals of an individual player mentioned above are illustrated in figure 2.

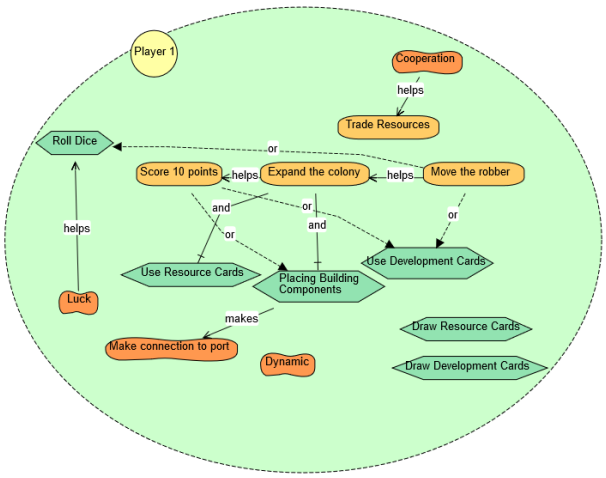


Figure 2: Goal of Players in Catan

While playing Catan, different dynamics[32] emerge. Players are kept in a state of suspense as **Randomness**[33] plays a major role. Even though the game is designed in such a way where players are at odds with each other, moments of **Cooperation**[34] can be achieved between players when ***trading*** *with each other*. Players can also use this **Cooperation**[34] to join forces to restrict another player higher in **Score**[7] to them from winning. However in this **Cooperation**[34] players can gain **Strategic Knowledge**[35] of each other and use this information against each other.

Various aesthetics[32] are experienced when playing Catan. Although **Luck**[36] is a major factor in the game we believe the **Challenging Gameplay**[37] introduced in the game, plays a more important role in determining the winner. The game stresses on the **Value of effort**[38] put forth by each player to determine the winner. However to ensure there is not a **Predictable Winner**[39], Catan introduces several different types of **Balancing Effects**[40] to the players lagging behind.

3.2 No Thanks!

No Thanks! is also a **Turn-Based**[28] **Multiplayer Game**[29] designed to be played by 3 to 7 players. Looking at the mechanical aspects[32] the game starts with a **Deck**[41] of **Cards**[11] and every player having 11 chips, which serve as **Resources**[15] to the player (variations: 9 chips for 6 players, 7 chips for 7 players). The game contains 33 **Cards**[11], which show numbers from 3 to 35. The **Deck**[41], which serves as **Drawing Stack**[42], consists of 24 of the 33 **Cards**[11], with 9 **Cards**[11] being removed randomly at the beginning of the game and their values kept unknown until the end. Every turn a player *takes a* ***Card****[11]* from the **Drawing Stack**[42] and *places it*

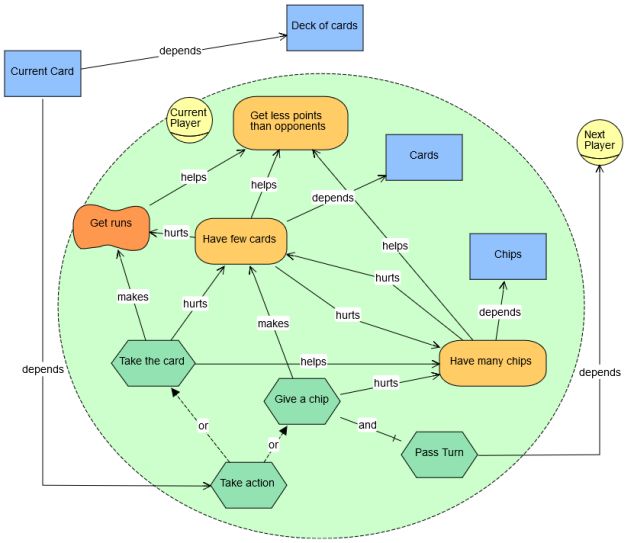


Figure 3: Model of a players' possible actions and goals in the context of the game

face-up. The player can then choose to either *place one of their chips* on the face-up **Card**[11] and pass the turn the next player or to *pick up the **Card**[11]* with all chips, that have been played on it, and *taking a new **Card**[11]* from the **Drawing Stack** and *placing it face-up*, starting a new turn. If a player has no chips left, the player has to *pick-up the **Card**[11]*. The game ends when the last **Card**[11] from the **Deck**[41] was picked up from a player. A **Score**[7] determines the winner of the game with the winner being the player with the lowest **Score**[7]. Every players' **Score**[7] is increased by the values displayed on the **Cards**[11] they picked up and decreased by one for every chip they have. This leads to goal dependencies as displayed in figure 3. If a player has picked up a **Run** of **Cards**[11], only the lowest value in the **Run** is added to the **Score**[7] with the remaining values in the **Run** being ignored.

While playing No Thanks! different dynamics[32] can play out. Players can suffer from **Analysis Paralysis**[43], as **Cards**[11] with high values get increasingly more chips attached and the value-cost **Trade-Off**[44] has to be considered between taking the high value **Card**[11], but receiving chips, and avoiding taking the high value **Card**[11], but taking the risk of potentially running out of chips. Player's can also try to predict other players actions and try to pass a **Card**[11] although they want to take it, expecting the **Card**[11] to eventually reach them again with more chips. Players can also keep track of the **Cards**[11] that have already been taken, and take **Cards**[11] that are two apart in value, expecting the **Card**[11] between to be in the **Deck**[41] to form a **Run** later on. Although players can make use of **Tactical Planning**[45], there is always some **Luck**[36] involved due to the uncertainty of the other players' actions and the **Randomness**[33] created by removing **Cards**[11] in the beginning and drawing **Cards**[11] in a random order.

The game can be experienced in different aesthetics[32]. Although there is some **Luck**[36] in-

volved, the game can be experienced as a challenge as the players compete with and try to game each other. While the time of game session of No Thanks! can vary due to e.g. **Analysis Paralysis**[43], a session of No Thanks! usually doesn't take too long to finish, so the game can conveniently be picked up as pastime.

4 Analysis of questions

4.1 RQ1: Keep players engaged

When considering Catan, the basic mechanics involved in instantiating your turn is to *Roll the **Dice**[30]*. The output of this mechanic generates **Randomness**[33] within the game. This creates a curiosity and **Tension**[46] within the Players, in order to observe how things unfold. This is why we believe **Randomness**[33] has been utilized to maintain the players attention[47]. Based on the result of the of the **Dice**, there might not be just one player *retrieving **Resources**[15]* but several of them depending on the placement of the building components. Through this design structure even if it is not the turn of the player, every player is still required to be actively engaged. We believe one of the most important pattern designed within Catan to keep it captivating is by incorporating **Challenging Gameplay**[37]. Introducing challenges motivates the players to be actively involved within the gameplay. As time passes and the difficulty increases, players must have expanded their colony to an adequate amount to help in the later stages of the game as illustrated in figure 2. However, in order to keep the players lagging behind engaged, Catan introduces **Balancing Effects**[40] in the form of *playing the Development Card*, to keep them engaged as well.

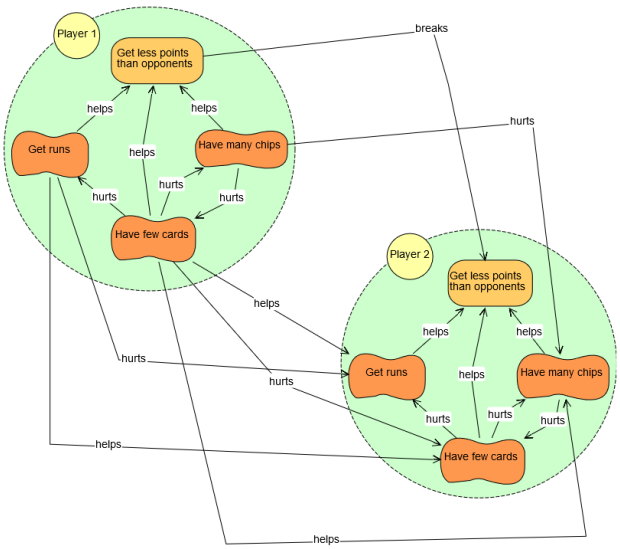


Figure 4: Influence of player's goals on another player's goals in No Thanks!

In No Thanks! the actions a player can take are few, as they can either *take a **Card**[11]* or *place a chip* on the **Card**[11] to pass it on to the next player. Most of the engagement in No Thanks! comes from analyzing the game and the **Trade-Offs**[44] other players are willing to take. As the players' goals collide with each other, as depicted in figure 4, opposing players' actions have

strong influence on a player. This allows **Tactical Planning** in No Thanks!, which can keep players constantly engaged, even when they are not the active player in that moment. No Thanks! also doesn't integrate **Player Elimination**[48] and provides a negative feedback loop in the **Trade-Offs**[44], which allows every player to have a chance at winning until late in the game, keeping players from losing interest early on in the game.

4.2 RQ2: End near stated time

When playing Catan, **Score**[7] is a key factor for ensuring the game ends within the stated time. Players in Catan must expand their colony by *using **Resource**[15] cards* to *place building components*, for which he must *draw **Resources**[15]* as illustrated in figure 5.

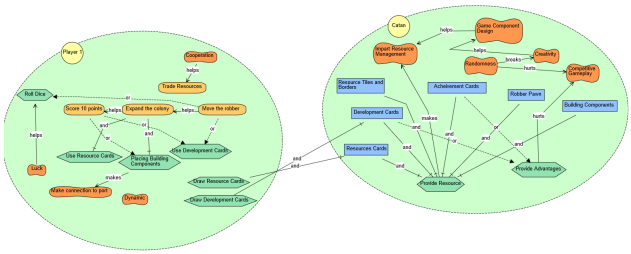


Figure 5: Expanding colony in Catan

Obtaining **Resources**[15] in Catan often requires effort and **Luck**[36]. However, to supplement this Catan provides some facilities to the player by allowing to **trade Resources**[15]. If the player is unable to ***Trade** with other players*, he can either ***Trade** with the Deck/Bank* provided he has the resources with him to replenish the deck after the trade (four identical **Resource**[15] cards in exchange for one) or ***Trade** at a port*. If the player manages to *place the building components* in such an arrangement that a connection to an available port is established, the player can manage to **Trade** with the deck using a lesser amount of **Resource**[15] cards then the original required amount. This aspect can be seen as a **Reward**[49] for the players efforts. If the player can manage to gather 3 knights or build at least 5 roads he can Acquire the Achievement Cards. With the Achievement card, the players are awarded with two points. This feature can be seen as a **Facilitating Reward**[50] for the player.

When compared with Catan, No Thanks! is quite a short game. Normally a game session of No Thanks! usually ends within 15 to 20 minutes. This is due to the game ending when all of the **Cards**[11] from the **Deck**[41] have been taken by all the players involved, which limits the game time by the amount of **Cards**[11], as depicted in figure 6. However, this is variable and can be prolonged from time to time by players over analysing their actions and getting stuck in **Paralysis Analysis**[43]. The game can also be elongated by players passing the turns often, but players having to *draw a **Card**[11]* when they run out of chips and providing every player with only a limited amount of chips, make the game end faster, as **Cards**[11] can not infinitely be passed between the players.

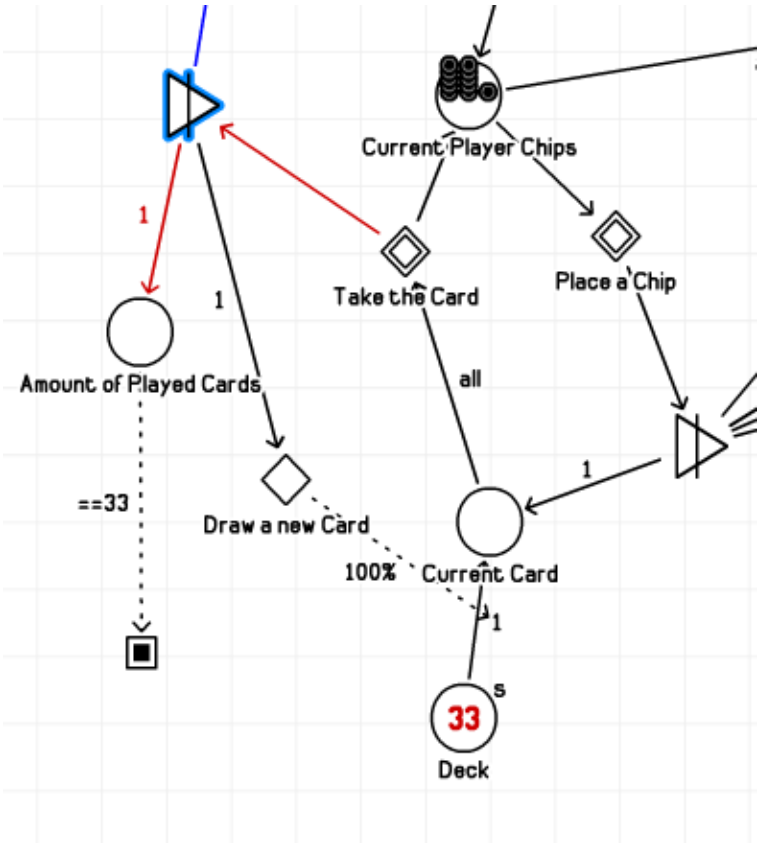


Figure 6: Machinations model of No Thanks! showing how the end state is reached

4.3 RQ3: Make players interact

In Catan, the fundamental mechanic for player interaction, is to ***Trade Resources****[15] with other players*. This creates **Cooperation**[34] amongst the players even though they are at odds with each other. The **Communication Channel**[51] established between the players when **Trading** has no constraints and the **Resources**[15] can be exchanged when agreed upon by both parties as illustrated in figure 7. Another interaction between players is when *drawing* ***Resource****[15] cards*. Depending on the result of the roll of **Dice**[30], more than one player might be receiving **Resources**[15]. However due to both mechanics mentioned above, players can gain **Strategic Knowledge**[35] about the others progress. If during a players' turn the result of the *roll of the* ***Dice****[30]* is seven, they get to move and *place the Robber pawn*. On whichever **Tile**[12] the robber pawn is placed, the players can not *draw* ***Resource****[15] cards* from there until the robber pawn is moved again as illustrated in figure 7. This introduces a **Symbiotic relation**[52] between the players involved.

In Catan even though players interact with each other to reach the same goal, but they do so as **Enemies**[53]. One example of this is that players can chose to omit from informing other players vital details like if they have managed to get the Achievement Cards if they have missed that themselves. There is no rule against this and the players can use this as an advantage.

One could argue, that passing a **Card**[11] to the next player by *placing a chip* can be seen as a method through which players interact with each other while playing No Thanks!, however we

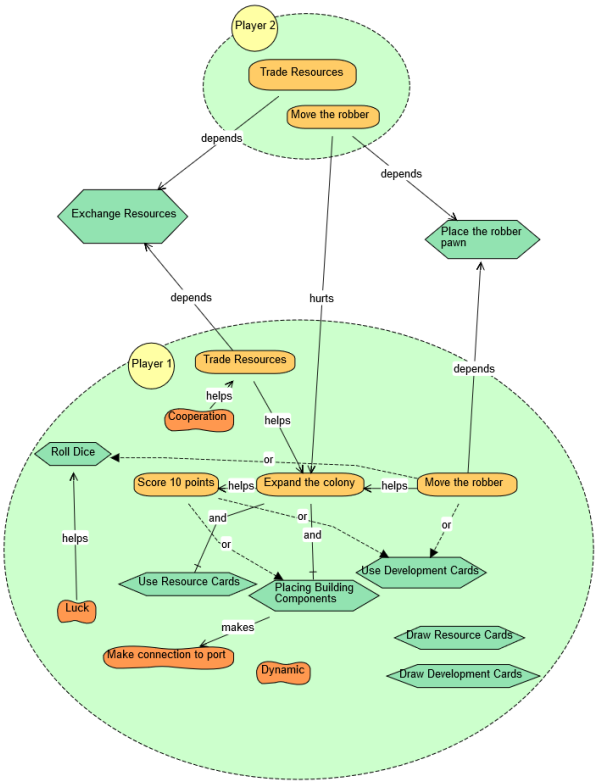


Figure 7: Player interaction in Catan: In the figure above essentially Player 2 is the same as Player 1. The current elements of Player 2 have been added to display the interaction between the two players

would not consider this action an interaction where players directly communicate with each other, as this action is only one directional. While No Thanks! does not provide a direct way of interaction between the players in the mechanics[32] like Catan's **Trading** where the players have to communicate and negotiate to reach an agreement. Players in No Thanks! interact with each other on a dynamics[32] level, by playing off each other. For example a player could pass a high value card, which would add to a **Run** for them, expecting other players not to take it and eventually being able to take the card with more chips, another player however might take the card just to interfere with the other player's planning. We would consider these kind of mind games a form of interaction between the players.

4.4 RQ4: Create feeling of achievement

When analyzing Catan, one of the obvious mechanics available to fulfill the feeling of achievement is when the players *use the **Resource**[15] cards* to *place the city* or when they *upgrade* their existing city to a settlement. Upgrading to a settlement **Rewards**[49] the player with more points as illustrated on figure 8 below.

Another mechanic could be when *drawing **Resource**[15] cards*, on either his turn or the other players. This is mainly dependent on **Luck**[36] but to increase this probability the player must have *placed building components* in enough quantities and strategic points on the board. This is

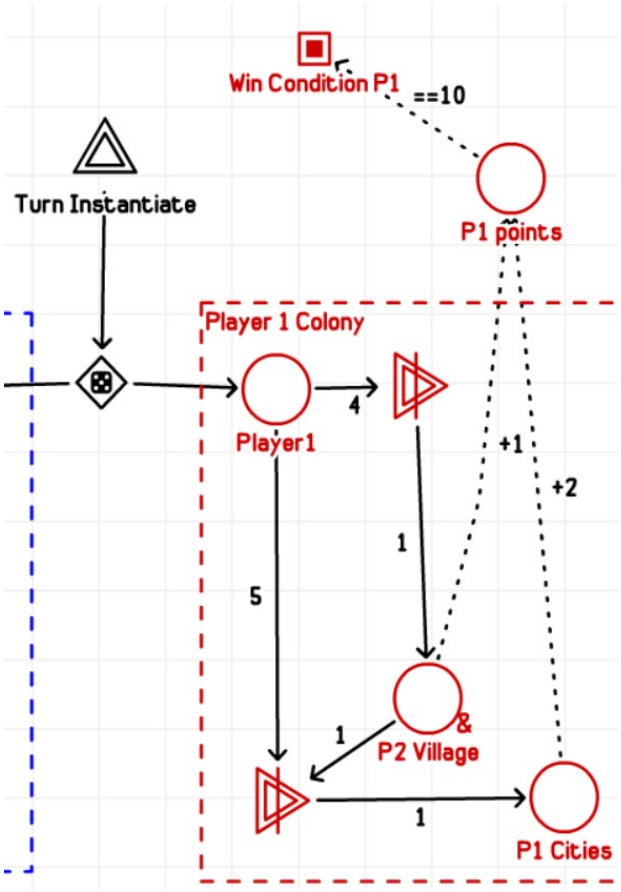


Figure 8: **Score** progression in Catan

the players' **Value of effort**[38] as it means they have spent time and effort, *drawing and using **Resource**[15] cards* to expand his colony. When *using the Development Card*, if the player is fortunate enough, they might have collected the largest Knight collection. This results in the player being **Rewarded**[49] with the Achievement card and an increase in his **Score**[7]. It can be argued that even when reaching a successful negotiation when ***Trading Resources**[15] with other players* can bring a feeling of achievement amongst players. However with this sense of achievement a player might believe they are actually acquiring something which will help them in increasing their **Score**[7], but due to **Uncertainty of Information**[54] they might have exchanged **Resources**[15] with the opposing player that might help the other player in winning the game. This creates a **Trade-Off**[44] where the player must risk other players potentially getting ahead in order to get what they require.

While playing No Thanks!, we observed there are several aspects through which a potential feeling of achievement can be gained. One example of such an aspect is, when a player is able to *draw a **Card**[11]*, which has many chips attached to it, so that the **Trade-Off**[44] actually feels more like a gain. This is especially the case, when the **Card**[11] in question is a high value **Card**[11] and adds to a **Run** for the player. This can again be furthered, if the player managed to plan passing the **Card**[11] for one or multiple rounds to get more chips from their opponents. Another example where the players can experience a senses of achievement is when the manage to force another player to *take a **Card**[11]* they did not want to take, when the player knows he has more chips than the other player, which can be seen as a form of "Schadenfreude", as in this case the feeling of

achievement comes from successfully increasing another players' **Score**[7].

5 Conclusion

In order to generate the i* model of the games we were instructed to use the Creative Leaf tool. There are two different versions of this tool available. Generally both versions use the same interface and functionality however, there were a few differences. In the Chalmers' version[55] of Creative Leaf one of the stencil's is mentioned as "Quality" but in the UK version[3] the same stencil is listed as a "Soft Goal". This difference caused some confusion for us as there seems to be a difference in the meaning of Quality and Soft Goals[56]. Another issue we observed is that the associations between the objects was not bi-directional. In order to portray the bi-directional association, two separate association links had to be made which caused unnecessary clutter on the window. Even though we found the tool to be quite self explanatory and easy to interpret, we encountered many issues when actually trying to use the tool. We found the tool to be very powerful and versatile however, we faced many complications when operating the interface available. In our case when trying to to show the relation between the same entities like the player, we had to create each of them separately. There was no utility available for selecting multiple elements together and duplicating them which could have saved time and effort.

In order to create models depicting the game progress towards the end state we used the Machinations tool. When compared with the Creative Leaf we faced no troubles in operating the tool. The interface was quite good and accurate however, implementing the operations on the elements was quite difficult. Insufficient help and guidance was available and considerable time was consumed in getting used to the tool when compared with Creative Leaf. However once the necessary knowledge to use the tool was gained, Machinations was quite smooth to use as the results could be verified immediately. Machinations is a powerful tool and can be used to model complex games like Diablo[57] and Crazy Taxi[58] but it became challenging for us to define a scale of complexity in fear of over scoping our model. In our opinion Machinations is a great tool for capturing almost every aspect of the game but in order to model the different parts of the game prior knowledge of the tool is required.

In our opinion we found Machinations to be a great tool for modelling the mechanics and constraints structured towards the end state but in order to capture the goals and the intentions of the players we found Creative Leaf to be a more useful tool.

6 Complete Models

6.1 i* Models

6.1.1 Settlers of Catan

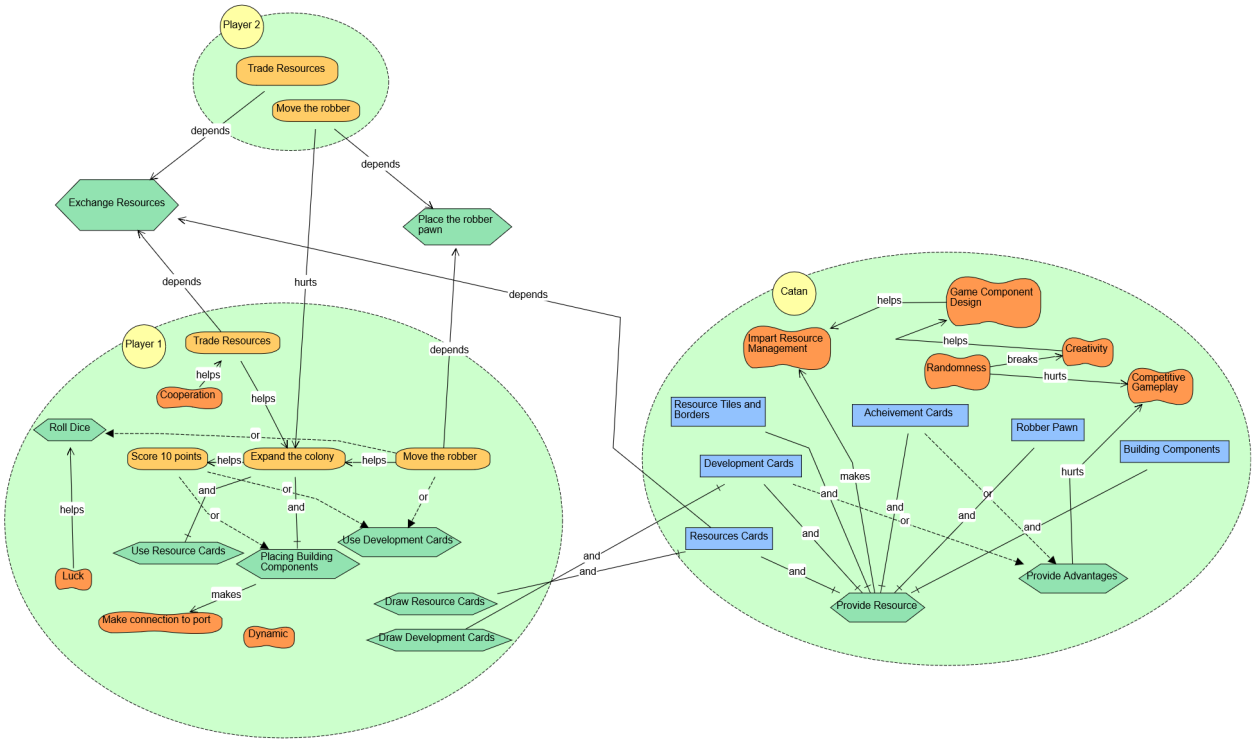
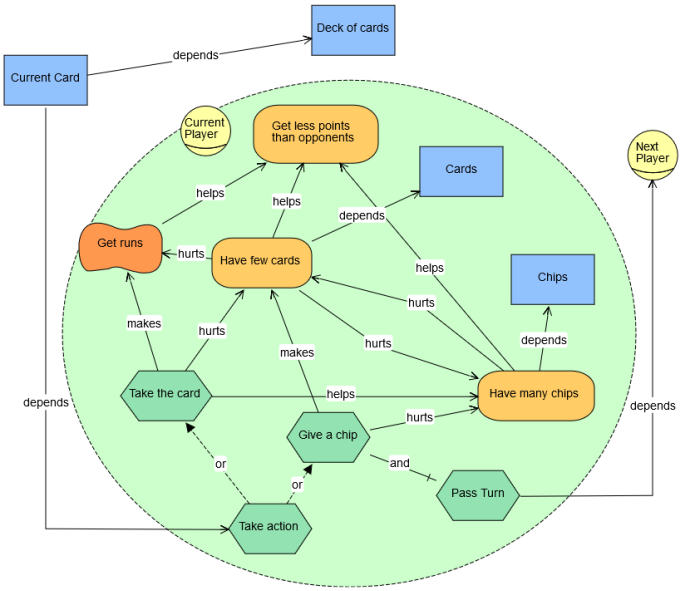
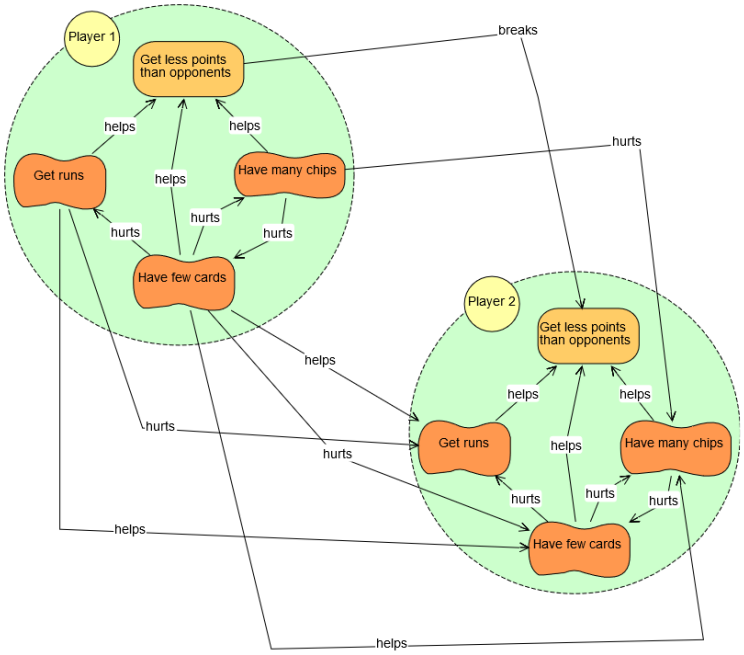


Figure 9: Complete i* Model of Catan: In the figure above essentially Player 2 is the same as Player 1. The current elements of Player 2 have been added to display the interaction between the two players

6.1.2 No Thanks!



(a) Relations of tasks, resources and goals within one player in the context of the game system



(b) Relations of a player's goals to another player's goals

Figure 10: Complete i* models for No Thanks!

6.2 Machinations Models

6.2.1 Settlers of Catan

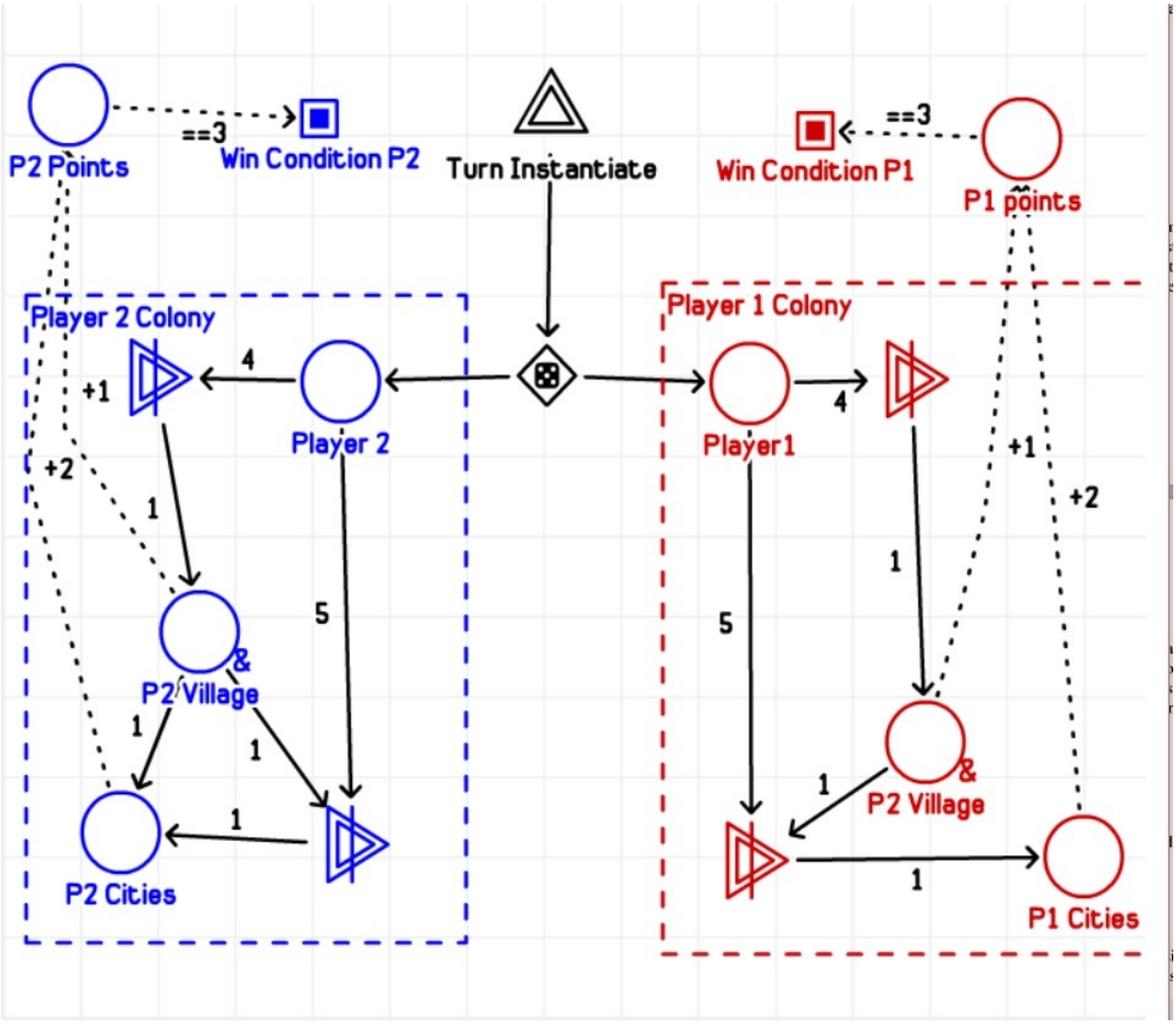


Figure 11: Complete Machinations Model of Catan

6.2.2 No Thanks!

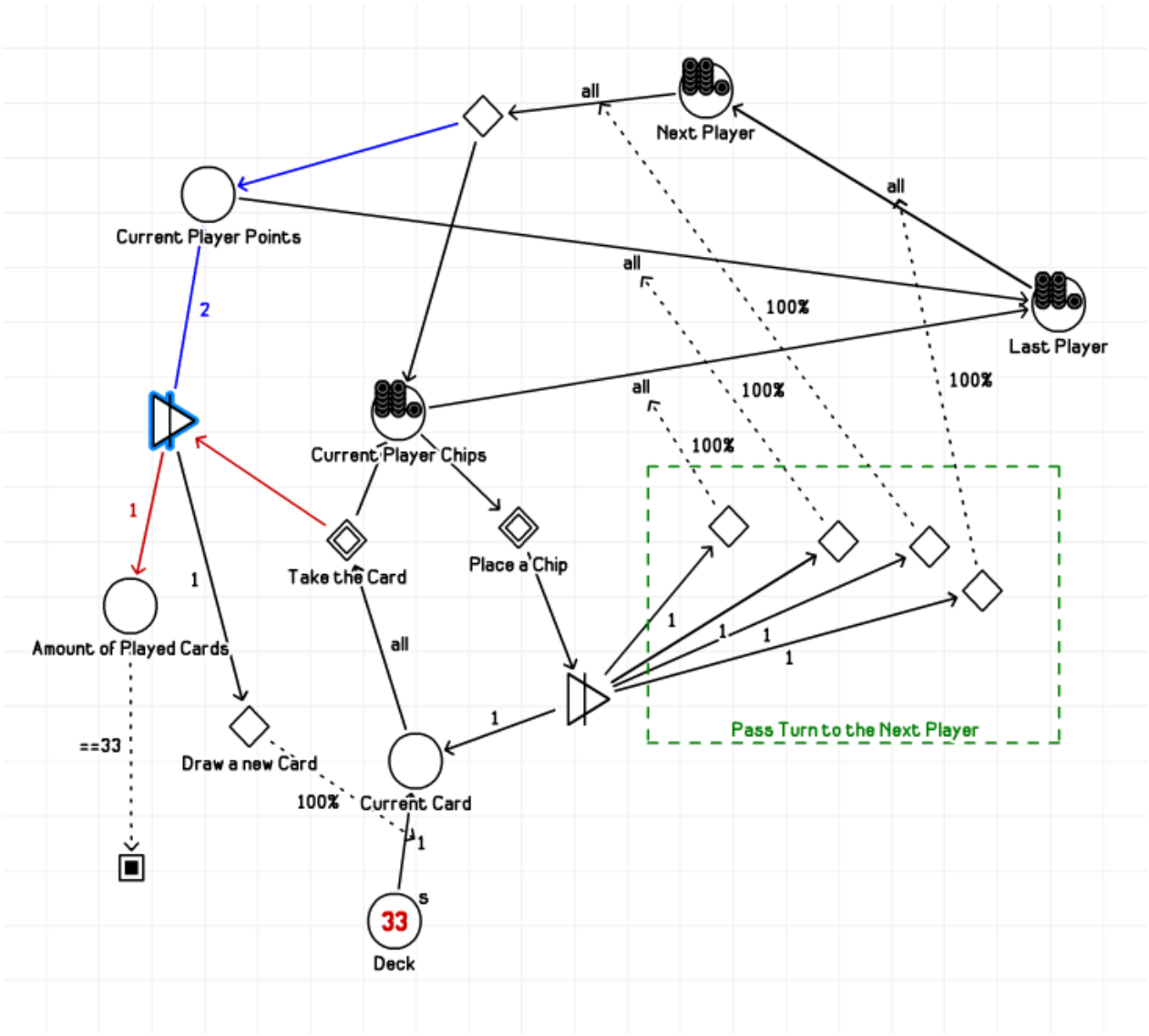


Figure 12: Complete Machinations Model of No Thanks!

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