# MINEROS: A COLLABORATIVE GAME FOR MINERS' REFLECTION.

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## ABSTRACT

In this paper I introduce Mineros, a board game that creates awareness around the use of mercury in artisanal mining communities and gives different scenarios for dealing with it. The approach was to understand the community and, through a game, create consciousness about their practice and present opportunities for the miners to join together and transform their practice. The game was made with two clear goals: first, to create a scenario for reflection in the mining community about mining practices and its social and environmental impact, second, to introduce the possibility of measuring their impact in water with a mercury testing device. During gameplay, players were transformed from independent miners to members of a mining community that deals together with mercury related issues exposing several conflicts that they face: Which gold extraction method to use? Which is the ideal way to mine for ore? Etc.; negotiating, sharing and reflecting around the dilemma to finally achieve the game's goal: transform together their practice from a mercury based one to a social and ecological responsible practice that benefits the entire community.

## INTRODUCTION

This paper exposes a design approach to an environmental and social dilemma around the use of mercury in artisanal gold extraction in Colombia. Artisanal practices have usually been regulated by people's mores and knowledge and not by laws; this usually creates tensions between artisanal practitioners and the government. Artisan miners ignore the impact of their extraction methods as they have done it the same way for years. Even if they know or ignore that mercury is a slow and silent killer, the available solution is cyanide, a substance that without the proper knowledge and equipment kills instantly. Artisanal miners keep trusting their practice, and find other solutions as impossible due to their lack of trust and knowledge, a knowledge that they are not willing to pay for on their own.

The approach was to understand the community and, through a game, create consciousness about their practice and present opportunities for the miners to join and transform. The game was made with two clear goals: first, to create a scenario for reflection in the mining community about mining practices and its social and environmental impact; second, to suggest to the community the possibility of measuring their impact in water with a mercury testing device (that would be designed in later stages of the project).

## THE CONTEXT OF THE PROJECT

Colombia is a country rich in water and gold. A situation that one may say is a contradiction in practical terms because usually the first one is sacrificed in order to get the second one. In Colombia, miners have been doing artisanal gold mining since pre-columbian times. Nowadays, mercury amalgamation is the most common way of extracting gold. This practice is widespread along the Colombian territory, but also in South America, Africa and Asia. It pollutes food, water, air and soil, being Colombia one of the most affected countries in the world by this cause (Cordy et al. 2011) The national government has implemented several measures to stop mercury pollution, with almost no impact. Many of these miners are organised in small cooperatives, making it hard for the government to make a substantial change by using law enforcement,

e.g. an average community of 200 miners can mobilise 1000 people by bringing their family members, making it almost impossible for the government to enforce law. In addition to this, mines are usually situated in isolated rural places with low accessibility, making it hard to track and even harder to surveil.

Our design project takes place in Quinchía, Risaralda, a municipality in the coffee triangle of Colombia. The town is located at 1830 meters (6000 feet) above sea level, 110 km (70 miles) by paved road (direction NW) from Pereira, capital of the department. It has an approximate population of 35.000 inhabitants from which 85.3 % declare to be able to read and write, but only 57.9 % completed elementary school and 20.6 % finished high school. The main economic activities are agriculture (being coffee the most common plantation), gold mining and commerce. The GNP per capita is very low: less than 2 US Dollars per day, being one of the poorest municipalities in the region, a factor that clearly increases the amount of informal miners looking for gold and wealth on the region.

There are several mines at the municipality in the surrounding mountains. The mine where the participating community works is located in Miraflores. This mine is part of the territory claimed by a foreign mining company, but artisanal miners have exploited it for more than 30 years. The mine from Miraflores is underground; this means that miners have to dig on the rocky soil to extract ore. The use of homemade powder and dynamite is common when excavating because the selling of powder is restricted to the government and the semi-legal situation of the artisanal miners in the current legal frame does not allow them to buy certified explosives. In this practice there are many risks specially related to rock falls, being that a common cause of death. Artisanal miners are used to these risks and speak naturally about recent death related to this cause.

After the ore is extracted, the miners grind the rocks into sand with a ball mill grinding machine and add mercury to it to create an amalgam that they can later recover while washing the sand. The resulting water goes back to the river contaminated with mercury. The amalgam is then heated evaporating mercury, releasing it to the air, resulting in a piece of gold.

## THE PROJECT

So, what can design do to face this situation? What is the role of design in the formerly exposed scenario?

Our project is called Río Mío (Spanish for My River) and its main goal is to create awareness about water pollution, not only in local communities, but also in communities that live far from the core of this problematic. Our initial goal with the project was to create a low cost mercury sensor with a platform to report the presence of mercury in water. But, on our quest for creating a report network, the real context started to emerge and, even if the main focus remained, the first approach to the conflict gave us a wide range of possible interventions, approaching design not as a “solving problems” practice but as a “setting problems” one (Lanzara 1983). This problem setting is, according to Lanzara, "essentially a transactive process, where different actors communicate, exchange, argue, and bargain their perspectives, values, and (even!) facts."(Lanzara 1983) Our transactive process was supported by social cartographies, which were used to generate spaces of discussion and agreement (Navarro-Sanint 2013). During this observation and analysis phase, the community clearly expressed a lack of awareness towards the use of mercury. We understood the mining practices; the needs and dreams of the community and the infrastructure where this takes place. To understand that for them Mercury is a slow killer. In adults, it is not until several years of use that the first symptoms appear, mainly expressed as neurological disorders. In children, symptoms are not clearly related to mercury, as they are usually evident as learning disorders that can also be related to other factors. For miners, the existence of just one elderly with no symptoms becomes the rule and the proof that mercury is not that bad. The evil of mercury becomes then a matter of faith.

On this first stage of our process, the community also shared their concern about the options that they have and expressed their lack of knowledge about other ways of conducting their mining practice, expressing that they needed external help to improve it. It is a common thought among miners that mercury is the most efficient way to get gold, ignoring and disregarding the severe consequences of its use. Mercury is used without any protection and it is thrown into water, land and air without taking into account the impact that it has on people and ecosystems.

Apart from the issues that the community openly expressed, some other important factors appeared during this part of the project. The stability of the cooperative was at risk due to the low economical support that the miners showed towards it. Miners live by the week. The gold they get during one week is sold at the end of the week, and most of that money is expended during the weekend in groceries and essential things for the house, in case that they have a family to support. Few of them save money for the cooperative making it impossible for the cooperative to start community projects that would benefit all of them.

To achieve the initial goal of reporting mercury, first, we had to show to the community that it was possible to alter their practice towards a more sustainable one. We had to respond to the complex scenario that the community showed us. Accepting that a goal of design is to modify practices through Things (Bjögvinsson et al. 2012). A pertinent question here is how can this be done in a context where enforcement has almost never worked. There are many laws that forbid the use of mercury, but the socio-political context of poverty and a violent past suggests that the transition from a severely

polluting community to a less polluting one is not through enforcement but through conflict resolution and participative decisions.

The design situation that we were facing then was the design of the mining practice. Considering design as "the creation of new meaningful artifacts in respect for an existing practice" (Iversen & Buur 2002), the Mineros game appeared as our "artifact" for gold mining communities to reflect about their own practice. It is not only meant for creating awareness but also for giving a possible direction for the community to follow, allowing them to decide about the future of the community and explore possible futures (Brandt & Messeter 2004). The game is our (when I say "our" I refer to the design team's and the community's) Thing to think with.

## THE BACKGROUND

Social innovation can be defined as the creation of tangible and intangible things (or Things) that are good for society and that enhance society's capacity to act (Murray et al. 2010). These social innovations can take shape as products or services, but they can also be something less tangible like principles, ideas, pieces of legislation, social movements, interventions, or a combination of them (Björgvinsson et al. 2012). On the previous definition, the word "thing" can be understood as the object, on its most common use; but, if we refer to its etymology, a thing can be an assembly (from Germanic þing) or the subject of deliberation in an assembly (from old english þing). In latin languages the word "thing" ("cosa", "coisa" or "chose") comes from the latin word "causa", meaning the reason of the conversation. Both definitions agree that this thing is more than the material object and refer to all the immaterial dimension of the object. As Bruno Latour puts it, things are socio-material assemblies and collectives of humans and non humans (Björgvinsson et al. 2012). For Björgvinsson et al. (2012) this switch from designing things (objects) to designing Things (socio-material assemblies) is the main challenge for designers in contemporary participation. They propose that this change should be achieved by using design Things for infrastructuring, designing potential "boundary-objects" that can support future design Things. With infrastructuring they mean creating the conditions that enable a proper participation of the actors involved, anticipating and envisioning use before actual use, in a sort of scenario for actors to envision future possibilities, on the same way that Brandt & Messeter (2004) design games work. Both, Brandt & Messeter and Björgvinsson et al. propose games as appropriate design Things for participatory design. Brandt & Messeter recall the importance of using scenarios as interpretations of design situations where, based on the possibility of rebuilding the scenario to restructure the situation (Schön 1983), participants can negotiate, change and explore possible futures (Brandt & Messeter 2004). Through scenarios participants have the possibility of envisioning not only the use before use of products, services, interventions, pieces of legislation, etc. , but also the intangible dimension of these creations: the practices that derive from those creations.

Scenarios can be used as spaces for practitioners to reflect about their practice, allowing participants to have a reflective conversation with the materials of their situation, reproducing their practice and revealing processes that are otherwise tacit (Schön 1987).

The previous definitions of Participatory Design, design Things and scenarios have some common elements with different definitions of games. According to Salen & Zimmerman's (2004) definition of games as systems "in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome", we could argue that all games are a form of scenario. All games are somehow real as even the most hypothetical realities of games reflect underlying realities (Koster 2013), and all scenarios are somehow artificial, and have certain rules, although the quantifiable outcome is usually set by each participant and not by the scenario itself. Games would differ from scenarios as they are the result of premeditated series of linked challenges on a simulated environment (Rollings & Adams 2003), lacking of the openness of scenarios that allow participants to act freely. We could claim then, that games are constrained scenarios that induce players to challenge conflicts resulting on what Sid Meier calls "a series of meaningful choices" (Koster R. 2013). In other words we could say that games are scenarios within an infrastructure. This gives a special value to games when using them in a social innovation process, as it frames the scenario to the context, creating spaces for infrastructuring.

Games can entertain, but games can also teach. There is a fine line between games that are meant to teach and games that are meant to entertain, as we always learn something through games, being more a learning scale of how much does the game teach us. Think about play as an essential part of games. For Huizinga (1955), play is something that all animals do, with the difference that play in humans is a rational action, stating that all play means something because there is always something "at play" that gives meaning to the action, suggesting a direct connection between play and culture and defining humans as homo-ludens. We could define games as layers on top of play, that provide players with possibilities to "use imagination, fantasy, inspiration, social skills, or other more free-form types of interaction to achieve objectives" (Fullerton 2014) and to face challenges. Play is an essential way of learning. Through play, we learn for example to talk, to trust, to recognise our limits; therefore, as we cannot disconnect games from play, through games we learn.

Considering the previously mentioned learning scale, we find Serious Games on one side of the scale, as games that have teaching as their primary goal. When referring to serious games, Tom Sloper expresses that "[g]ames have power. Games have the power to teach,

to train, to educate. Games have the power to bring people together-young, old, and in between. Games have the power to reveal and build character. Games have the power to retain and promote health. Games have the power to heal." (Michael & Chen 2005) All this happens through a series of interactions between players that are defined by the players roles, perspectives, concerns, and interest in a scenario that is built as a common place for conflict negotiation (Bjögvinsson, Ehn & Hillgren 2012) According to Fullerton (2014), games can have one of 7 different interaction patterns of players, meaning the structure of interaction between the participants and the game system can take several forms: (1) Single player versus game, (2) multiple independent players versus game, (3) player versus player, (4) unilateral competition, many players vs one player, (5) multilateral competition, where 3 or more player compete against each-other, (6) cooperative play, where all the players compete against the game system, and (7) team competition, one team against another. These patterns are defined according to the interaction where the main conflict arrises, as all games have inherit conflicts in their gameplay that players have to challenge to achieve a specific goal. In Fullerton words, "[g]ames challenge players to accomplish their objectives while following rules and procedures that make it difficult to do so" (Fullerton 2014). Those difficulties can come either from the game, another player or from both.

Consequently, we recognise the value of games as tools for modelling design scenarios, for exploring design in real life and for improving current design practices with the active participation of actors.

## THE GAME

To achieve a fast and easy reflection of the players towards their practice we decided that the aesthetics (Hunicke, LeBlanc & Zubek 2004) of the game should be as close to reality as possible, as the game is intended to be played by real miners. Miners should feel that they are mining, otherwise the connection to their practice would be hard and the reflection would be even harder to achieve. Therefore, we decided to create the game as a direct analogy of mining, and to use metaphors to simplify some of the activities.

When starting to design the game, the first formal decision was which kind of game we were going to make. Our observation suggested that the underlying conflict was between the miners and their knowledge and organisation. This made us think about a collaborative game, where all the players had to challenge the game system. Although the game do follows the pattern of a cooperative game, it is not made explicit during the setting of the game. The other patterns of game are also open for the players to decide how do they want to face the challenge, allowing them to reflect on their organisation as a team. The winning conditions are set so the easiest way of facing the challenge is to use the collaborative game pattern.

Then we defined the structure of their practice. During the observation phase we identified 3 phases: (1) extracting ore, (2) milling the ore to get the gold and (3) selling the gold. Some of the miners have these 3 phases clearly defined during a week time, others do it daily, depending on the amount of material they gather.

Thus, the initial prototype of the game had 3 parts, each one of them for a different phase of the production cycle, although, only the second phase, when the mercury is actually used, could be modified by players during gameplay. This was a good way to make the miners feel that they were capable to change mercury use, but we realised that the intention of the game should not be only to persuade them to change mercury for something different. If we wanted them to really reflect about their practice we needed to include some more elements that would make them take more decisions and experience how they could achieve a holistic change. Some other factors were then taken into account and added to the variables of the game, creating a board that could be modified in several ways: the possibility to improve their extraction activities, their safety, to switch technologies, to be more environmentally and socially responsible and to value cooperative work.


Figure 1: Game board.

What we now call the final game (Figure 1) is based on the previously exposed production cycle with 3 phases. It is a board game with 42 cells divided in 3 sections, each section composed by 14 cells. During gameplay the initial setting can be modified with 5 tiles that can be bought reducing the total amount of cells to 21, half of its initial amount, suggesting a more efficient production cycle. This allows players to explore different possibilities and opens a space for discussion and reflection among the players.

Before starting the game, each player (a minimum of 4 and a maximum of 6 players) chooses a game-piece and

receives 10 health points, 70 mining credits (in the form of paper bills) and a personal board that he has to complete to claim that he has completed all the steps to extract gold. Gameplay respects turn taking rules. Each player has his own turn. On each turn the player can throw the die, move and make a decision depending on the cell were he stands. Players can acquire knowledge anytime during their turn. The available knowledge is: retorts, gold cyanidation, the gravimetric method, drilling and blasting, occupational safety, mercury measurement, agro-mining and cooperation. All this knowledge has a different value and each one is represented by a tile that modifies the board, according to what it represents, e.g. mercury measurement increases the amount of clean water that can be collected and allows the player to earn health points on selected cells.


Figure 2: Surprise Cards

The first section of the cycle is the acquirement of the required products for gold extraction. At the start of the game the only product available is mercury. Each player has to decide whether he wants to buy or not a certain amount of mercury that is indicated on the player's current cell. This mercury is received as tokens marked with an icon allusive to mercury. Some other products can be acquired later on after one of the player buys a knowledge that makes it possible, e.g. acquiring the gravimetric method knowledge allows players to buy gravimetric tokens that can be replaced by mercury tokens when extracting gold. The second section of the cycle is ore extraction; getting loads of ore. In this part of the game players get an amount of ore according to the amount of health points that they have, relating health with the capacity of working and extracting gold. Each load is received as a token marked with an icon allusive to ore. The third section is getting the gold from the ore. On this section water is essential. Each player receives the amount of water indicated on the player's current cell. The player randomly takes this water from a bag. Water tokens can represent safe water or polluted water. The player loses one health point for each token that indicates that the water is polluted, relating health with polluted water. During gameplay, players can also win or loose health points and money with the Surprise Cards (figure 2). These cards have events like visiting the hospital or paying taxes, among others. When each player reaches the end of the cycle, he can sell his production if he has filled his personal board. Only when this personal board is completed the player can claim that he has extracted gold and then he exchanges the filled board for some mining credits.

Players have to achieve 2 goals to finish the game. First, they all have to extract gold without using mercury; by setting this goal we give an explicit direction to the practice modification that the legal frame requires. Second, they have to acquire the cooperation tile that goes in the middle of the board; this is the demonstration that they are able to transform their practice, as this is a transformation that is expected to happen outside the game, when they have to decide to face the game differently. This is the goal that will make them work together towards achieving a communal goal and will transform the interaction structure into a collaborative one.

The game defines a uniform role for players: they are all miners, leaving the possibility for each player to choose his own role. This allowed players to interact just as they do it on the mine.

## THE OUTCOME

The community was located far from us and it took us some time to reach them, as a result, we did several tests with students and colleagues before making the trip and taking it to the community of miners. During those tests the dynamic was refined and the game proved to be entertaining but the main objective could not be proved, as there were no miners playing the game, therefore there was no practitioner that could reflect on their practice and that could use it as a scenario of their own reality.

Figure 3: Gameplay

Later, the game was played with real miners from the same community that participated during the entire process (figure 3). 6 players and 5 observers participated in a session that lasted about 2 hours. We will refer to them as Facilitator (F), Miner 1 (M1), Miner 2 (M2), Miner 3 (M3), Miner 4 (M4), Miner 5 (M5), Miner 6 (M6), Observer 1 (O1), Observer 2 (O2), Observer 3 (O3), Observer 4 (O4), and Observer 5 (O5) (Figure 4). Some of the observers were also miners.

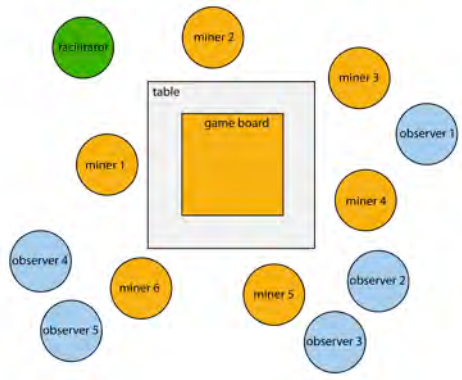


Figure 4: Position of the participants during gameplay.

COMMON LANGUAGE AND KNOWLEDGE

On the first round of the game, one of the players expresses some differences between a term used in the game and their own term for that, referring to mercury as quicksilver but immediately clearing it out using the former term. The game served as a way to set a common language between the parts, as later all the participants were using the terms suggested by the game (transcript 1).

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| M1 : "Two of quicksilver. Two of that thing you call mercury." |

Transcript 1: Setting a common language.

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| F: "You can buy mercury or a retort." |
| M5: "The retort" |
| M4: "Come on that you are good for the retort" |
| M1: "Give me the retort" |
| F : "OK". |
| After receiving the retort tile and placing it on the board: |
| M1: "Look guys , this is how you are supposed to play this. Why didn't you buy the retort?" |
| M5: "I told Polo [M4] to buy it." |
| M1: "And I bought that to leave it there!" When realising that the tile modifies the common board. |
| [...] |
| M1 receives a booklet with information about how to build a retort. |
| M1: "So I take this with me! This is good!" |
| [...] |
| M1: "I can take this with me, can I?" |
| M2: "The retort?" |
| M1: "This knowledge is more valuable than everything else you are buying there." |

Transcript 2: The importance of knowledge.

During this session we proved that miners did suffer from a lack of knowledge about different ways of changing their practice. They were eager to buy knowledge, not for succeeding in the game, but for learning in real life. Every time that a player bought a knowledge in the game, he received a tile to modify the board, but he also received from the facilitator a booklet with the required information to implement that knowledge in real life. This booklet was referred by one of the players [M1] as being more valuable than anything else in the game. At the end of the game, the same player distributes the previously acquired knowledge booklets to the other players (transcript 2).

UNDERSTANDING THE ANALOGY

The game was also well understood as an analogy of the mine and was understood by the participants as a representation of their practice. At one point, players wanted to explore the possibility of buying and selling game resources between them. When they asked if they could, one of the observers immediately assumed that they did, by stating that they are at the mines (in the game) and therefore they can behave just like they do there. This shows that the relation between the scenario and the reality was understood by, at least, one of the participants and then by the rest of the players (transcript 3).

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| M1: "Old guy, sell me those, you already have it." Pointing at the recently acquired ore tokens with his mouth. |
| M5: "Give him fifty thousand there." |
| M1: "You have it already. Sell me those, that ore" |
| O1: "You will get money." Talking to M6 |
| M1: "You will get money." Talking to M6 |
| M1: "You have ten, yes you can get money." Talking to M6 |
| M1: "Can we do this?" Asking to the facilitator. |
| O1: "It's business and we are at the mines." Assuming that they are allowed. |
| M1 : "Yes, we are at the mines." Affirming that they are allowed. |
| After giving M6 the money. |
| M1 : "Give them to me, it's a cycle that I can save." |
| M1 : "Guys this is what people call game strategy." |

Transcript 3: Confirming the analogy.

A SPACE FOR DISCUSSION

The game did work as a space for discussion about their practice, involving not only players, but also involving observers, who participated actively on the discussions in every decision they had to make. When deciding whether to buy or sell their production 6 participants intervened on the discussion: F, M1, M2, M5, M6 and O4; each one of them giving his point of view about the situation (transcript 4). Also, participating in other players' decisions, despite the competitive approach that M1 was showing during gameplay (transcript 5).

One of the observers even saw it as a space for reflection. This observer clearly stated that it was useful for seeing how one "works the mine", clearly expressing a reflection about his practice (transcript 6), and another one even recognised the value of collective work when reflecting on what happened during the game, but relating it to real life (transcript 7).

During M2's turn:
F: "Do you want to extract some ore?"
M2: "With all the ore I already have!"
F: "How much health do you have?"
M6: "No, [M2] has too much there!"
M1: "Hey! Sell it to me!"
O4: "Buy it yourself. You can buy his load." Talking about the ore.
M5: "No! And what if he has bad luck?"
M1: "No, not load because he already has."
O4: "He has money..."
M1: "No. But he needs water."
M1: "But don't you see that no one has water".
M6: "No one has water."
M1: "Water is the most scarce thing in this game."

Transcript 4: A space for discussion.

During M6's turn:
M1 : "You see! You have all you need to mill, you have mercury, you have ore..."
O1 : "You have mercury, ore and health!"

During M2's turn:
M1: "Will you buy mercury? No." Suggesting that he shouldn't buy more.
M2: "No, I won't buy more."

Transcript 5: Participating in decisions.

O1: "You can see how you work the mine. If you work it well or not."

Transcript 6: Reflecting on his practice.

M4: "So now one knows that it's better as a group."

Transcript 7: Referring to their real life practice.

TRANSFORMING THE SCENARIO

During gameplay, players had the chance to transform one scenario to another.

On the first scenario, players assumed two different interaction patterns:

1. The game as a multilateral competition where all players compete with each other and to accumulate money seems to be the ultimate goal (transcript 8).

After M6 receives 5 tokens of water:
M1: "Damn! This old guy is going to beat us!"
O1: "He has everything."
M4: "He has money, he has..."
M6: "I have money, I have health, I have ore, I have water,..."
M5: "You have mercury."
M6: "I have mercury."

Transcript 8: Multilateral competition.

2. The game as individual players against the game. Players focused on beating the game system through the acquisition of personal resources, even if they did not make it explicit.

This transformation was interesting as it started as an exchange of products provoked by the evidence that, in order for them to extract gold, they had to gather a certain amount of resources. Those resources have to be collected on each player's personal board, making visible what they had and what they missed. As these boards were available for other players to see, they all started to compare and to explore exchange opportunities. This dynamic resulted on an open market that benefited all the players, who started to make businesses under the table exchanging tokens especially while it was not their turn. On this market even health was negotiated by players who had money but no health, exchanging it with players with no money but with health (transcript 9).

M4 gives 2 health point tokens to M3.
M4: "Here I have a lung for you."
M3: "Give me 5, give me 5."
M4: "You told me that it was 2."
M3: "5, for 50."

Transcript 9: Negotiating health.

FROM COMPETITION TO COLLABORATION

During gameplay players transformed their behaviour even while maintaining their roles. Some of them apparently understood the intention of the game since the beginning or simple behaved like they are used to behave in real life, being collaborative when needed. But, one of the players had as his main goal to win the game on his own and it took him some time to understand that the game suggested a shared victory (transcript 10).

After M1 received 50 mining credits as a surprise gift because he sold his farm crops:
M1 : "Look Polo [M4]." Showing off his money to M4.
M4 : "But we are just beginning suddenly I can have more money than you."

F: "Why do you want them to die?"
M1: "So we are less! No?"

Transcript 10: Expressing competition.

It was noticeable that he (M1) passed gradually from being the most competitive player to being the facilitator and the manager of the collaborative process (transcript 11). Later, players started to collaborate with communal goals that they stated through discussion, and began to request good results from other players (transcript 12).

At the end, all the money was on the table and belonged to everyone. Each personal board became a shared board and the goal was to fill this board together (transcript 13). Players referred to each other as "we" and express a shared happiness when achieving communal goals (transcript 14).

At the end of the game, all the players celebrated together, contrasting with the initial desire of beating

others that was expressed at the beginning of the game session.

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| M1: "Someone collaborate with 150." Refering to mining credits.<br>M6: "I have 120"<br>M3 gives 30 to M1<br>M3: "And 120..."<br>M1: "150, here it is"<br>M1: "Drilling and blasting to see if we can win this thing!"<br>F : "It costs 300"<br>O5: "You are short by 10"<br>F : "You are short by 10. Who gives 10?"<br>M2 gives 10 without hesitating. |

Transcript 11: Managing the collaborative process.

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| M5: "What are we doing?"<br>M1: "We are starting a company here!"<br>M2: "Yes. We have to join..."<br><br>During M4's turn:<br>F: "There are drilling and blasting or occupational safety"<br>M6: "Gus, buy occupational safety"<br>M5: "Drilling and blasting"<br>[...]<br>M6: "Oh no! And what we need is health." |

Transcript 12: Setting a collaborative practice.

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| M3: "Agro-mining" Suggesting that we wants to buy that knowledge.<br>M2: "Ah! We almost fill it!" Suggesting that they almost acquire all the knowledges. |

Transcript 13: Communal achievements.

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|---|
| M1: "350! No! we are still short on money!"<br>M1: "we won this!" |

Transcript 14: Talking about “we”.

## CONCLUSION

During this process we discovered many things. We understood the capacity of games to build a common language for discussions and the power of games as analogies of real life, when they are close enough to reality to be understood by the participants. We proved that games work as infrastructures for scenarios, allowing the participants to modify those scenarios in participatory sessions. That games are indeed good spaces for participating and discussing about the intangible dimensions of design creations and practices.

On the other hand, the miners discovered that they can work together for the sake of the community, that there are other ways to extract gold, and that their practice is not static and can be modified.

Even if some more exploration is needed around this topic, now its time to take advantage of the replicability of board games, that will allows us to bring it to each gold mining community to start transforming practices through reflection.


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