Gamification to Support the Run Time Planning Process in Adaptive Case Management

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Abstract. Adaptive Case Management is used to manage unpredictable processes. These processes are mostly knowledge oriented and different roles need to collaborate to carefully plan the next steps during the execution of a case. These next steps cannot always be planned ahead, but depend on events and changes and differ for each instance. During the execution period the actual model of the run time planning, of a particular instance of a case, is made. For different roles to easily plan the correct next steps, it is important that such a case can be conceptualized and communicated. In this paper we suggest the idea of using game elements, or *Gamification*, to enhance the planning process during the execution of a case. With the use of Gamification we hope to make this process more recognizable for people and create better involvement by engaging the familiarity of games. The use of role-playing games is already being used for workshops and requirements elicitation. By building on existing work in Adaptive Case Management and Gamification we show that most games and the planning process of a case are in some respects similar. More in particular, we will discuss how we can learn from games to improve the team play during the planning process of a case. Finally this idea will be explained through an example of a planning process for an unpredictable case.

Keywords: *Adaptive Case Management*, *Gamification*, *Modeling in Run Time*, *Communication, Games.*

1 Introduction

This paper will focus on unpredictable processes and how specialists can be supported in their jobs to discuss and model the progress of such a process. A good example of an unpredictable processes is that of a patient in a hospital. It is hard to predict how a patient in a hospital will be treated. Only during the actual treatment of the patient, next steps will become applicable and available. Several specialists discuss the progress of the treatment plan and together plan

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next steps accordingly. In fact they are modeling the actual process during the execution of such a *case*. During a modeling process, communication is vital [1]. The participants engage in communication to create an 'agreed model' [2]. During such modeling, the *process* is of paramount importance [3]. A sound process is key to understand and improve the quality of modeling [4]. With a clear goal in mind, remodeling the planning to involve next steps in the handling of a case, participants need to work together in a form of *team play*. In this paper we suggest the idea of using game elements to improve this modeling process. The use of game elements in a non-game context, or *Gamification* [5], is not a new phenomenon. Hoppenbrouwers et al. [3] discussed how Gamification can be used to improve the quality of modeling of a method or tool. In this paper we will discuss how Gamification can be used to improve the *run time modeling process* of unpredictable processes. We will discuss parallels between unpredictable processes, run time modeling, games, and the proposed approach. Next we will give a case example of how this process could function. This case example will be that of the unpredictable process of the patient in the hospital and several physicians working together and communicating to model the next steps in the treatment plan of the patient. This paper reports the first step in a line of research taking the perspective that we can learn from games to support the management of unpredictable processes. Our goal is to design and create a procedure or method using elements from games to enhance and support the way of working of knowledge workers. We therefore work under the Design Science paradigm [6].

2 Adaptive Case Management: Two Level Approach

Business processes are present within every organization. Managing these business processes is of importance for an organization. 'Business Process Management' (BPM) was introduced to help manage these processes within organizations. BPM traditionally was used to manage predefined workflows [7], but not all processes are routine and well structured. Some processes are unpredictable and knowledge oriented. Adaptive Case Management (ACM) can be used to manage such processes [8,9]. A definition of ACM is given in [10]: "Adaptive Case Management is a collaborative, dynamic, and information-intensive process that is driven by outside events and requires incremental and progressive responses from the business domain handling the case". ACM is designed with the goal to support knowledge workers and their processes in an organization [8,11]. Each instance of a case is unique [11,12], and the process around it is also unique. This paradigm differs from traditional workflow management [8]. Whereas the process in workflow management is always the same and uses a procedural style, the processes in ACM evolve around a specific case (or instance) [8,13]. ACM allows for more flexibility in processes to support variations in the case. Variations in a case occur when an event happens [8,14,15]. These events can be seen as 'dynamic events'. Dynamic events can change the context of a particular

case [14] and can be internal or external [14,16]. To support dynamic events, adaptivity during run time is required [13]. Within ACM we can distinguish two levels of models:

- Fixed Model
- Run time planning

The first is the model in design time based on the meta model for case management models. Such a model consists of different *states* where a case passes through and *plan fragments* from which a caseworker may choose during run time. These plan fragments consist of one or more tasks following some kind of procedure. When dynamic events or changes in a case occur, the system or knowledgeworker has to choose between plan fragments, both available and applicable, to handle this specific instance based on the new context [8,11] and in fact model the actual planning in run time. To model this *run time planning* or 'treatment plan', different roles are often required [17] and should collaborate [11,17,18] to achieve the desired outcome for a case. This paper concerns the modeling of the run time planning of ACM and we propose the idea of using *Gamification* to support this process.

3 Gamification and the Connection to ACM

The use of games within organizations is becoming more mainstream. The term 'Serious Games' is often used, especially in view of management games [3]. Here games are used to learn something about eg. a new method. By using a game format, learning became more enjoyable. The idea this arises of using game elements to make every day work more fun, interesting and user friendly. *Gamification*, a relatively new term which is getting more and more attention. Deterding et al. [5] describe Gamification as: "an informal umbrella term for the use of video game elements in non-gaming systems to improve user experience and user engagement". Next to this improvement, Gamification also aids user friendly conceptualization, communication, visualization and the manipulation of conceptual objects [2,3,5]. As stated in the previous section, during the execution of an instance of a case it is important for all roles to collaborate to commit on a decision. This decision is the next step in the handling of a specific case. By introducing game elements, this collaboration could be supported. McGonigal [19] wrote about collaboration within games: "Gamers agree to play by the same rules and to value the same goal. They practice shared concentration and synchronized engagement". The same is true for the modeling of the run time planning. All roles need to agree to work by the same rules (eg. laws, policies, business rules) and make decisions to achieve a goal (the description and change of the run time planning). This modeling of the run time planning can be seen as a *role playing game* (RPG). We see these RPGs more and more taking form in *Massively Multiplayer Online Games* (MMOG). The biggest missions in MMOGs are called 'Raids'. where players need to work together to defeat

a 'boss'. Raiding represents the most complex form of simultaneous interaction between groups of players and the design structure of the game [20]. Raiding is not just doing a mission together, but is highly collaborative and communicative. Williams and Kirschner [20] stated: "'Raiding' is generally considered among gamers and scholars alike to be the most challenging form of collaborative play". The process of modeling the run time planning is such a collaborative play and much like a raid. Both ACM and games are based on 'meaningful play'. Van Bree and De Lat [21] stated: "In well-designed games we see autonomous individuals, devising short and longer term strategies, reacting to changing situations, absorbing and processing the information needed to complete their task at a fast rate. This behavior is what happens when meaningful play occurs." Salen and Zimmerman [22] described meaningful play as the goal of successful game design and it emerges "from the relationship between player action and system outcome.". To understand game design and to explain how games are quite similar to ACM it helps to distinguish the core elements of games. There are three elements of games described as depicted in Figure 1. The inner circle are the rules of the game, in ACM these can be seen as the business rules and the fixed model. Van Bree and De Lat [21]: "The rule set is communicated through the representation or declarative layer which is shown on the screen". In ACM this is the current state and applicable data of a specific instance of a case. The outer circle depicts where the actual behavior of players takes place. This is the communication between different roles to model the run time planning in ACM. In this paper we see the run time planning process (and communication within it) as the actual work, with the goal to describe and change the run time planning to meet the *objectives* set to complete a case. By designing this process as a game we can inspire effort, reward hard work and facilitate cooperation and collaboration [19] to ultimately enhance the user experience, user engagement, user friendly conceptualization & communication of this process.

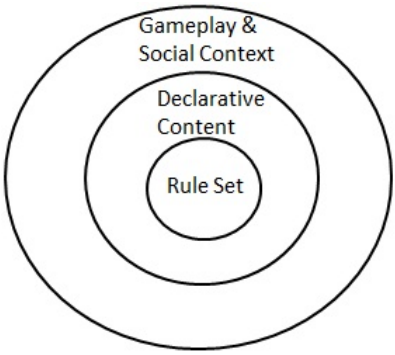

Fig. 1. Elements of games (Salen and Zimmerman [22] & Van Mastrigt [23])

4 Situation and Analysis

The actual modeling process of the run time planning in ACM has a goal driven perspective. Every model serves or works towards at least one clear, utilitarian purpose [24]. In the case of run time planning, it is the description and change of the run time planning. As we stated before, the communication during this process is key. During this collaborative process, different roles "move through a process in which they combine their expertise, insights and their resources to bring them to bear for the task at hand" [25]. If the complex and dynamic collaborative interactions involved are not properly organized and supported, the benefits that potentially accrue from them may not be realized [2]. Ssebuggwawo et al. [2] hypothesize that the interactions that take place in collaborative modeling sessions can be looked at as a game. This section is based on, what in Argumentation Theory [26] is referred to as, Dialogue Games [27]. McGonigal [19] states that a good MMOG has a good game world (eg. players, locations), good game mechanics (eg. game rules, direct & clear results, objectives) and it has a good game community (eg. positive social interaction, meaningful context for collective effort). In the case of the run time planning process in ACM we have the following game elements of an MMOG:

- **Game world:** The *players* in the game are the caseworkers, or the physicians in the health care example. Players can play different kind of *roles*. In ACM there are different kind of knowledge workers which can be involved with the case. In the health care example, we have different kinds of specialists. The *game arena*, or location, is the case itself. In the context of the case, the caseworkers propose their ideas of next steps. Within this game world we can also identify several *game pieces*. In the run time planning process, the game pieces can be identified as the planning fragments in the case.
- **Game mechanics:** By using *game rules*, communication during the run time planning process can be structured. For this we propose the use of *communication items*, which will be explained later in this section. It is also important to have some direct & clear *goals*. These goals need to be made clear every time this run time planning process starts. Two questions need to be asked. What do we have? & What do we want? To answer the question of 'What do we have?' we need the current case (and all the applicable and available data relevant to the current state of the case) and our plan so far (what steps did we take). And to answer the question of 'What do we want?', we need to know what we want to achieve, what the scope is (the focus) and what indications there are. After we have set the goal of the run time planning process, we can create the *objectives* for this process (the final goal and maybe some sub-goals).
- **Game community:** The social interaction between the experts can be supported by the game mechanics stated before. This interaction must always be in context of a *collective effort*. Next to the goal of this run time planning process, this is (in context of the health care example) to make the patient well enough to leave the hospital.

Conversation during processes like the run time planning process involves negotiation, which results in accepts, rejects, modifications , etc., [2] (see, for example, [27]). To support this negotiation during the run time planning process, we propose the use of several *communication items* based on the 'Speech Act Types' proposed by Ssebuggwawo et al. [2] and communication activities proposed by Rittgen [28]. These communication items are listed in Table 1 and can be seen as a game mechanic.

Table 1. Communication items

Communication item	**Purpose**
(Counter)Propose	Proposing or counter proposing a planning fragment
Argue For	Providing an argument for the proposed planning fragment
Argue Against	Providing an argument against the proposed planning fragment
Agree with/Commit	Agree on or commit to the proposed planning fragment
Disagree with/Reject	Disagree on or reject the proposed planning fragment
Ask Question	Asking a question about the proposed planning fragment
Pass	No contribution at this moment

The communication items can be seen as the *moves* a player can make during this run time planning process. It is also possible for a player to pass when the player has nothing to add at this moment. By using Gamification we can organize the interactions during this process, so benefits that potentially accrue from them can be realized. The suggested game elements, how they map on ACM terms and their link to the health care example (which is explained further in the next section) are shown in Table 2 .

Table 2. Link between game elements, ACM terms & Health care example

Game elements	**ACM terms**	**Health Care Example**
Players	Caseworkers	Physicians
Game arena	Case/Run time planning	Treatment plan
Game pieces	Plan fragments	Proposals (eg. tests)
Game play (turn-based)	Modeling process	Creating a treatment plan
Moves (communication items)	Communication on the run time planning	Communication on the treatment plan
Game rules	Design time model	Eg. Policies, Laws, Business Rules & Who makes final accept/reject
Roles	Knowledge workers	Specialists
Objectives	Goals	Goals

By structuring the team play in this modeling process, by introducing these game elements, we hope the entire process could become more user friendly, dynamic, flexible, purposeful, efficient & effective.

5 Example of Team Play Design

To show how these Gamification additions to the run time planning process in ACM might function, we will now give an example. As stated before, the example of a case we will give is that of the treatment of a patient in a hospital. This is a very knowledge intensive and unpredictable process. At a high level we can make a design of this process from the viewpoint of the physician. Eg. Admission, diagnose, treat & dismiss. These can be seen as the states a case can be in. While in a state, the case worker (in this case the attending physician) can choose how to act. Especially in the 'diagnose' & 'treat' states, the process can be highly unpredictable. Now we will give an example of how such a case might be managed and specifically how the run time planning process might take place.

A patient is admitted to the hospital, where a physician is assigned to the patient. The first step is to diagnose the patient. The modeling of the run time planning starts here. This modeling process can be done by the physician her/himself. The physician changes the run time planning based on the applicable and available data in the case (eg. anamnesis and current symptoms), and maybe consolidates other physicians. The next time this modeling process takes place is when a dynamic event happens. This can be when eg. a result from an ordered test is received. Based on this new data (and change in the case), the modeling process of the run time planning starts. In Table 3 we listed a simplistic example of a conversation being done by the physicians proposing a test regarding the case. During this conversation we can see the use of several communication items. In Table 4 we can see which communication items were used. The conversation during the process of modeling the run time planning starts off by introducing a proposal. This proposal, a planning fragment in ACM, is the game piece a player (physician) places on the game arena (the model of the run time planning of the case). This process could eventually be visualized by placing a physical game piece in some sort of model of the game arena.

Table 3. Example conversation during modeling of run time planning

Player	**Conversation**
Physician A	Because of *"some indication"* I would like to propose we do a blood test
Physician B	I agree to this proposal, because a blood test could rule out *"some" disease"*
Physician C	I do not think that we should do a blood test, because *"some argument"*
Physician A	...
Physician B	I do not agree with you, because of *"some argument"* I think we should do a blood test first
Physician C	...
Physician A	That is indeed why I suggested the blood test
Physician B	Agreed
Physician C	You are correct, lets first do a blood test
Physician A	Okay so our next step is to do this blood test

Table 4. Communication items in conversation

Conversation	Communication item
A: ... I would like to propose ...	Propose
B: I agree ..., because ...	Argue For
C: I do not think that we should do ... because ...	Argue Against
A: ...	Pass
B: I do not agree with you, because ... we should do ...	Argue For
C: ...	Pass
A: That is ... why I suggested ...	Argue For
B: Agreed	Agree with/Commit
C: You are correct ...	Agree with/Commit
A: Okay so our next step is ...	Agree with/Commit

The players each take a turn to make a move, using a communication item. In our example, at the end of the conversation all the players agree/commit to the proposal. It could also be the case that consensus is not reached between players. To make a final decision we should look at the game rules of the process. They might state that there will be a senior player (eg. the attending physician) that will make the final decision whether or not the proposal is accepted or rejected. Or the game rules might state than a certain percentage should agree to the proposal before it is accepted (this might vary from 50% to 100%). When a proposal is accepted or rejected there may be another proposal by a player. When more than one proposal has been accepted, the same process can also start for the temporal ordering between the next steps. By the use of Gamification we can organize this kind of communication about a case.

6 Conclusion and Future Research

As knowledge oriented processes become more mainstream within organizations, and the need to manage these (mostly) unpredictable processes with ACM, we have argued in favor of the use of Gamification to support the process of modeling the run time planning. We have discussed recent work on ACM and discussed the two levels of this approach, where we focused on the planning of next steps at run time. We also presented why we think we can learn from games and how Gamification could support this planning process, and specifically the communication during the modeling of this run time planning. We concluded that we could organize this process by using several game elements. Such as the use of: *players*, *game arena*, *game pieces*, *game play*, *moves in the game*, *game rules*, *roles* & *objectives*. We have only described one piece of ACM which can be supported by Gamification. There are still some other areas left in ACM where Gamification could provide some support, such as the execution of the steps in run time & the (collaborative) design of a case in the design time of ACM. To help establish these research streams we have argued how the modeling of the run time planning can be supported by Gamification. This theory contributes to

Gamification and ACM research by providing conceptual constructs about Gamification, ACM and a basis for enhancing a process with the use of Gamification. Furthermore, to fully understand how Gamification can be used to enhance the modeling process of the run time planning, an initial pilot game could be created and tested in a knowledge intensive organization (eg. a hospital). In the near future, we plan to carry on in this line of work in a recently started PhD project that this paper is a first product of. Our applied aim is to lay a foundation for Gamification to support ACM.

References

1. Veldhuijzen van Zanten, G., et al.: System Development as a Rational Communicative Process. Journal of Systemics, Cybernetics and Informatics 2(4), 47–51 (2004)
2. Ssebuggwawo, D., Hoppenbrouwers, S., Proper, E.: Interactions, Goals and Rules in a Collaborative Modelling Session. In: Persson, A., Stirna, J. (eds.) PoEM 2009. LNBIP, vol. 39, pp. 54–68. Springer, Heidelberg (2009)
3. Hoppenbrouwers, S., et al.: Method Engineering as Game Design: an Emerging HCI Perspective on Methods and CASE Tools (2012)
4. Hoppenbrouwers, S.J.B.A., Proper, H.A(E.), van der Weide, T.P.: A Fundamental View on the Process of Conceptual Modeling. In: Delcambre, L.M.L., Kop, C., Mayr, H.C., Mylopoulos, J., Pastor, Ó. (eds.) ER 2005. LNCS, vol. 3716, pp. 128–143. Springer, Heidelberg (2005)
5. Deterding, S., et al.: Gamification. using game-design elements in non-gaming contexts. In: CHI EA 2011 CHI 2011 Extended Abstracts on Human (2011)
6. Hevner, A.R., et al.: Design science in information systems research. MIS Quarterly 28(1), 75–106 (2004)
7. van der Aalst, W., van Hee, K.: Workflow Management: Modellen, Methoden en Systemen, 2nd edn. Academic Service (2004)
8. Swenson, K., et al.: Mastering the Unpredictable: How Adaptive Case Management Will Revolutionize the Way That Knowledge Workers Get Things Done. MKPress (2010)
9. Swenson, K., et al.: Taming the Unpredictable Real World Adaptive Case Management: Case Studies and Practical Guidance. Future Strategies Inc. (2011)
10. Moore, C., Le Clair, C.: Dynamic Case Management: An Old Idea Catches New Fire. Forrester Research (2009)
11. Weeks, D.E.: Adaptive Case Management: Taming Unstructured Process Work for Today's Knowledge Worker. OpenText Global 360 (2011)
12. Chevron: Future of BPM survey, Chevron (2011)
13. Silver, B.: Case Management Solutions, Case Management Demystified. Webinar Global 360, BPMS Watch (2009)
14. Mecella, M.: Adaptive Process Management. Issues and (Some) Solutions. In: Workshop on Enabling Technologies: Infrastructure for Collaborative Enterprises, WETICE 2008, pp. 227–228 (2008)
15. Kemsley, S.: Enterprise 2.0 Meets Business Process Management. In: Handbook on Business Process Management 1 International Handbooks on Information Systems, pp. 565–574 (2010)
16. Antic, D., et al.: On a New Approach To The Business Processes Modeling. Automatic Control and Robotics 10(2), 199–204 (2011)

17. Miller, D., Shepherd, T.: Winning in the New Normal: Adaptive Case Management Strategies to Deal with Business as it Happens. Whitepaper Global 360 (2011)
18. Moore, C.: Delivering exceptional customer service. Webinar global 360, Forrester Research (2011)
19. McGonigal, J.: Reality is broken: Why games make us better and how they can change the world. Producer, Massachusetts (2011)
20. Williams, J.P., Kirschner, D.: Coordinated Action in the Massively Multiplayer Online Game World of Warcraft. Symbolic Interaction 35(3), 340–367 (2012) ISSN: 0195-6086 print/1533-8665
21. van Bree, J., de Lat, S.: Complex Systems and Emergent Behavior: Engaging with Computer Games to Enrich Organization Studies. Nyenrode Research Paper no. 11-05 (2011) ISSN 1872-3934
22. Salen, K., Zimmerman, E.: Rules of play: game design fundamentals. MIT Press, Cambridge (2004)
23. van Mastrigt, J.: The big bang. Dutch Gamedays, Utrecht (2006)
24. van Bommel, P., Hoppenbrouwers, S.J.B.A., Proper, H.A., Roelefs, J.: Concepts and Strategies for Quality of Modeling. In: Halpin, T.A., Krogstie, J., Proper, H.A. (eds.) Innovations in Information Systems Modeling, ch. 9. IGI Publishing, Hershey (2008)
25. de Vreede, G.J., Briggs, R.O.: Collaboration Engineering: Designing Repeatable Processes for High-Value Collaborative Task. In: Proceedings of the 38th Hawaii International Conference on Systems Science, p. 17c. IEEE Computer Society Press, Los Alamitos (2005)
26. van Eemeren, F.H., et al.: Fundamentals of Argumentation Theory: A Handbook of Historical Backgrounds and Contemporary Developments. Lawrence Erlbaum Associates, Mahwah (1996)
27. Hoppenbrouwers, S.J.B.A., Proper, H.A., van der Weide, T.: Formal Modelling as a Grounded Conversation. In: Goldkuhl, M., Lind, G., Haraldson, S. (eds.) Proceedings of the 10th International Working Conference on the Language Action Perspective on Communication Modelling, LAP 2005, Kiruna, Sweden, pp. 139–155. Linkpings Universitet and Hogskolan I Boras, Linkping (2005)
28. Rittgen, P.: Negotiating Models. In: Krogstie, J., Opdahl, A.L., Sindre, G. (eds.) CAiSE 2007. LNCS, vol. 4495, pp. 561–573. Springer, Heidelberg (2007)