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ABSTRACT

We are interested in how virtual, synchronous teams organize to cope with tasks of different complexity. We follow an explorative approach to validate World of Warcraft as experiment platform for virtual teams. We explore which parts of the game are suitable for experiments, which phenomena can be studied in teams fighting in World of Warcraft and how data can be collected. We prototypically evaluate data from games to demonstrate the validity of our approach.

Keywords

Teams, Virtual Teams, Experiment Platform, World of Warcraft

INTRODUCTION

The 14th Americas Conference on Information Systems is dedicated to the topic **Learning from the past & charting the future of the discipline.** Games have always been an important instrument to experience collaboration and to develop soft skills as e.g. leadership and co-operability. Today, for players in *Massive Multiplayer Online Roleplaying Games* (MMORPG) like *World of Warcraft* (WOW) who take the game seriously, the online world is a non-negligible setting for acquiring soft skills and to experience collaboration in virtual teams. In the future, young adults will have a considerable amount of experience in Online Gaming and those experiences spill over to professional settings.

Mastering the game settings of WOW is not trivial. Individuals and teams need to acquire knowledge about strategy, tactics and skills, take advantage of different skill sets and organize a team. We are interested in how virtual, synchronous teams organize to cope with tasks of different complexity. We argue that WOW is an attractive experiment setting. As users enjoy the game, it is feasible to run long-term experiments. In this paper, studying WOW as experiment platform, we explore which parts of the game are suitable for experiments, which phenomena can be studied in teams fighting in WOW and how data is collectable. We prototypically evaluate data from games to demonstrate the validity of our approach.

This paper is organized as follows. We present a WOW introduction, a brief literature review of (virtual) teams, complexity of team tasks and workflow models followed by the method. Presenting a prototypical evaluation of data from some experiments is followed by a discussion of our findings which concludes the paper.

WORLD OF WARCRAFT

WOW is a MMORPG with a high fantasy virtual motif represented in a Tolkien-like, medieval style. The main motive is to protect the own tribe against wild monsters and other tribes. Users are represented as avatars (usually referred to as characters) and can play individually but numerous game situations require users to team up to explore the virtual world and fight together. This strong team aspect is particular for WOW. The so called mobs (mobile units) are opponents provided by the environment.

A character has skills – to some extent individually configurable – armor, weapons and useful items according to its level. Fighting against mobs, solving quests and fighting in instances are awarded by experience points to slowly increases the character's level (1 (novice) – 70 (highest)). Instances are fixed environments accessible only to one team at a time. A special instance has a constant structure (number, location, strength of mobs) and can be used as reproducible environment to play in. Characters have different resources:

- Mana is necessary to cast spells and available e.g. for warlocks, priests and mages.
- Rage increases short-range fighting capabilities e.g. for warriors or druids

Table 1 summarizes these character classes used later in the paper.

	Short distance fighter	Long distance fighter	Healer	Mana	Rage	Specialty / Role in fights	
Warrior	x				x	Heavily armored to absorb damage Attract mobs to have the highest aggro which is the attraction level of a mob. The one with the highest aggro gets attacked.	
Shaman	x		x	x		Medium armored Can place supporting totems e.g. to heal or to increase the damage rate	
Druid	x		x	x	x	Medium armored Can support warriors in attracting mobs to protect lightly armored characters Can change its Gestalt to make damage or to attract mobs according to the fight situation	

	Short distance fighter	Long distance fighter	Healer	Mana	Rage	Specialty / Role in fights	
Priest		x	x	x		Lightly armored Can revive group members Has numerous DoTs (death overtime casts causing damage to mobs over a period of time)	
Warlock		x		x		Lightly armored Controls a magical, enslaved creature Has numerous DoTs	
Mage		x		x		Lightly armored Can slow down mobs through freezing	
Hunter	x	x		x		Medium armored Controls an animal (pet) Can place traps (e.g. to freeze mobs or slow them down)	

Table 1. A collection of character classes

Figure 1 depicts the screen in a fight from a warrior's perspective and is explained in Table 2.

Figure 1. In game fighting situation

Nr	Description
1	Player´s character with health and rage indicator
2	Focused mob with health indicator
3	DoTs
4	Character focused by the mob
5	In-game signs given by the team leader
6	Buffs on the own character
7	Mini-map of the current area
8	Omen – Addon showing the team characters' aggro-rate
9	Cooldown indicator bars – indicates remaining time of dots and spells against the mob
10	Action bar
11	Chat log
12	Combat chat log
13	Team members with health and mana/rage indicator

Table 2. Screen items

LITERATURE REVIEW

We are interested in how virtual, synchronous teams organize to cope with tasks of different complexity. The objective of this research is to develop an experiment framework for research on teams in WOW. In the literature review we look at models providing guidance on how to describe a team, how to classify "virtuality" of teams and how to classify the complexity of tasks and workflow patterns.

Teams

Do the small groups of WOW qualify as virtual teams? A team is a collection of people small in number but few enough to be able to communicate and interact with each other regularly to reach a common goal (Homans, 1950; Hirokawa, Cathcart, Samovar and Henman, 2003). This definition includes five factors: (1) number of people, (2) shared purpose of the team, (3) interdependence of the players, (4) the perceptual boundary of the team and (5) interactions between the players. For building of a capable transactive memory system (TMS), which is a metaphor for a specialized division of labor within a team to encode, store and retrieve knowledge from different domains (Wegner, 1995; Kanawattanachai and Yoo, 2007), frequent and rich communication is crucial.

Number of team members

Too few people lack the ability to communicate and to interact in such a rich way that good ideas can arise and that an adequate TMS is established in the team. Too many people tend to regroup and do not communicate and interact equally and mutual (Loch, Tyler and Lukose, 2003). Three to seven members constitute a creative working team (Hirokawa et al., 2003). The WOW instance teams we want to observe consist of five players.

Shared purpose

A team is established to fulfill tasks and consequently it has to identify common shared purposes. Team members can have additional individual goals (Hirokawa et al., 2003) but necessarily they need to have a common and correct understanding of the issue to be resolved (Gouran and Hirokawa, 2003). Issues include questions of *fact*, *conjecture*, *value* or *policy* (Gouran, 1982; Gouran and Hirokawa, 2003). Questions of fact can be answered objectively. Questions of conjecture deal with predictions of future situations under a possible and probable set of preconditions. In WOW instances the prediction of a future fight is a question of conjecture. Questions of value are about ethical and moral judgment of the teams' constitution of beliefs, attitudes and behavior. WOW teams resolve, who earns precious items dropped by a boss. Questions of policy deal with possible courses of action to handle a situation. WOW teams have to plan their actions according to possible situations and available capabilities.

Interdependence of team members

To accomplish tasks high interdependency of team members is desired by design to enrich available information, resources or competencies within the team. WOW teams combine sets of capabilities never available to an individual character but necessary to solve tasks. Each player in the team depends on the decisions and actions of their teammates. Inconvenient actions by single players frequently cause complete wipes.

Perceptual boundary

Teams tend to use their own language, to develop behavioral characteristics, to wear uniforms or find other ways to distinguish themselves from its environment. The WOW community creates special language artifacts and a unique kindness that is common to most of the players (Nardi and Harris, 2006; Nardi, Ly and Harris, 2007). In instances, the team is by itself and the technical platform provides the boundary for outsiders to interfere.

Interactions

WOW teams interact in numerous ways. Communication to create mutual situational understanding is important. Teams act jointly with every player disposing of special capabilities. The numerous spell casts and heal casts, the protection of players weak in armor and other functional interactions are very important interactions in WOW teams.

Virtuality

Virtual teams are small groups of geographically and/or temporally dispersed members mediated by communication and information technology (Jarvenpaa and Leidner, 1998; Piccoli and Ives, 2003) and organized to fulfill one or more tasks. These teams are often temporary and culturally diverse, created for distinctive tasks and often without any mutual history of the members. Teams can be characterized along three dimensions "Type of Group", "Interaction Mode" and "Context" (Jarvenpaa and Leidner, 1998). The virtual WOW team is specific in being synchronous.

Complexity of tasks

According to Smith (Smith, 1988), a problem refers to the gap between a current perceived situation and the desire about that situation by individuals. Thus problem solving is about the achievement of some goal to transform situations towards the desired status by the problem solver. Smith utilizes four conceptualizations to describe the structure of a problem (Smith, 1988):

- Goal state conceptualization – structures the problem according to the clarity of the definition of the goal state. The goal state of a structured problem is clearly describable whereas the goal state of an ill-structured problem is not.
- Problem space conceptualization – structures the problem with regard to all states and all transformations between them. A structured problem can be divided into an initial state, a goal state and all possible intermediate states which can all be represented explicitly (Simon 1973) whereas an ill-structured problem cannot.
- Knowledge conceptualization – structures the problem according to the necessity or availability of the knowledge that the problem solver needs. To solve structured problems all knowledge is available but to solve ill-structured it is not. A transformation might be possible when new knowledge can be acquired
- Process conceptualization – structures the problem according to the availability of an adequate solution procedure. Coping with ill-structured problem means no effective solution procedure is available for the problem solver.

Goal state and problem space conceptualizations are problem solver independent. The latter are not.

The overall goal state of a WOW instance is given by a friendly computer character and quite clear. With regard to the goal state the problem is structured. Notwithstanding, intermediate states and sub-goals are as well uncertain as unclear. The problem space of the task given in a WOW instance is huge and with respect to the uncertain and numerous interactions in the team and in the team of opponents ill-structured. The knowledge available in an instance team depends on the players and the experience of the team – the TMS. A WOW instance is w.r.t. the knowledge conceptualization ill-structured when the team enters the instance the first time. It gets more structured the more experience the team has in that instance. The process to solve the task of a WOW instance gets clearer the more experienced the team is in that instance. In a new instance the overall process is quite unclear and TMS has to develop. The WOW instance problem is ill-structured according to the conceptualizations presented above.

Modularization of team tasks

A team task can be structured as being an additive, disjunctive or conjunctive task with respect to the contribution of the team members to the team task (Steiner, 1972; Frank and Anderson, 1971; Lam, 1997). An additive task can be accomplished by adding the performance (of the same function) of each team member to one team result. To solve a disjunctive task only one member of the group – the one with the best result – contributes the solution of the team. The group has to identify and to choose this single best solution. In conjunctive tasks the group only performs as a whole and the group's performance is limited to the performance of the weakest member.

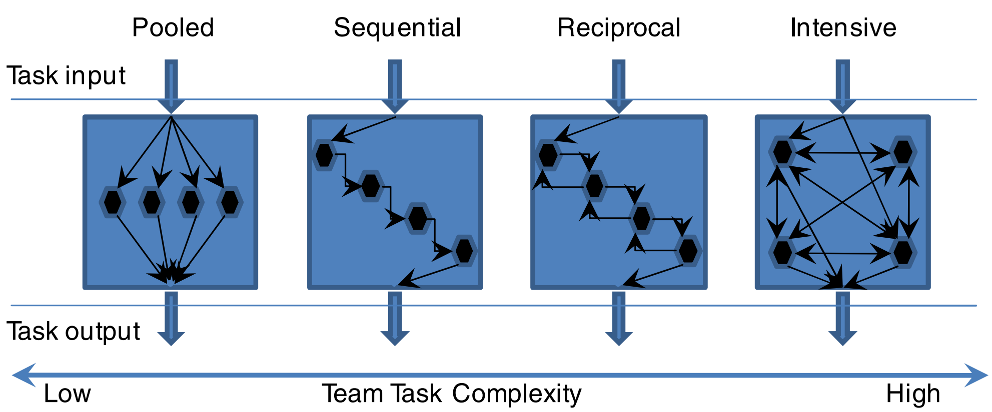

Figure 2. Workflow Processes in Teams (Bell and Kozlowski 2002)

A conjunctive task is more challenging than an additive or a disjunctive task with respect to the team's internal processes of communication and interaction. In a conjunctive task team members are highly interdependent what raises complexity. To solve a conjunctive task the team's internal workflow processes have to be adequate for the problem (Ven, Delbecq and Koenig, 1976; Bell and Kozlowski, 2002).

Figure 2 depicts four different workflow arrangements with different levels of complexity according to (Bell and Kozlowski, 2002). In the pooled or additive arrangement work is done by all 4 team members separately and compounded to a team solution. In sequential or reciprocal arrangements work flows between pairs of team members either unidirectional (sequential) or bidirectional (reciprocal). The most complex arrangement is the intensive one. Team members identify problems and solve them together with spontaneous sets of interactions and communications. Only the intensive arrangement is adequate to solve conjunctive tasks. WOW instances are conjunctive w.r.t. the uniqueness of capabilities and skills provided by the individual characters of the team which have to be arranged highly dynamic and spontaneous to cope with the time pressure and uncertainty given through the environment.

So we argue that WOW instance tasks are complex (ill-structured) following the conceptualizations of (Smith, 1988) and w.r.t. the expectable intensive internal workflow arrangement within the teams according to (Bell and Kozlowski 2002).

METHOD

The objective of our research is to develop a research method to evaluate how virtual, synchronous teams perform and organize in complex endeavors. So we hypothesize that WOW is a useful experiment platform. We follow an explorative approach to find WOW settings, measurements and analysis methods. Our research method is inductive action research according to the classification from (Cassel and Johnson, 2006) of action research. I.e. we – the authors – participate in WOW gaming to qualitatively collect data and generate an interpretative understanding (Cassel and Johnson, 2006).

Between October 2007 and February 2008 we played the game of WOW and explored the game setting and developed the personal skills and the characters. In an iterative approach we identified *instances* as complex and controllable team tasks, developed and refined technical means to record interaction and collect data. We played those instances in various settings (different sets of characters) and analyzed occurring phenomena.

As our result we aim for a positivistic approach through experiment action research (Lewin, 1946; Cassel and Johnson, 2006). Figure 3 depicts our research approach. The box symbolizes the research method that we applied prototypically and that is the result of this paper.

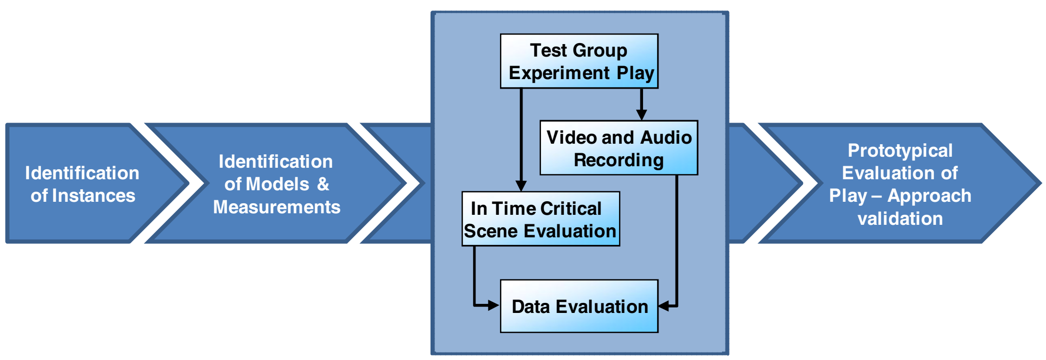

Figure 3. Method to design WOW experiments

EXPERIMENT PLAY

Table 3 depicts our experiment settings. We used voice chat (teamspeak), text chat (provided by WOW) and in-game signs for communication and coordination purposes. We played three different instances once and one twice and had one fight in an open area at the entrance of an instance. We selected those examples as the most interesting one of our gaming experiences. The length of the instances (time of video recording) ranges from 29 up to 108 minutes. The number of wipes is one indicator for the difficulty of the task for the team. When a team is fully wiped all group members go down and in a partial wipe some teammates go down. An instance comprises a collection of mob fights (in our examples 13 up to 41 fights) most often fights against one mob.

As part of our prototypical analysis we describe the two first instances, how we fought and performed with the objective to demonstrate the phenomena occurring in fights to find out whether the WOW setting is useful to explore virtual team processes.

Instance name	Blackfathom Deeps (Tiefschwarze Grotte)	Entrance to Razorfen Kraul (Eingang zum Hügel der Klingenhauer)	Scarlet Monastery – Graveyard (Das Scharlach-rote Kloster – Friedhof)	Scarlet Monastery – Library (Das Scharlach-rote Kloster – Bibliothek)	Scarlet Monastery – Library (Das Scharlach-rote Kloster – Bibliothek)
Team setup	Warrior-Lvl-26 Hunter-Lvl-28 Shaman-Lvl-24 Priest-Lvl-27	Warrior-Lvl-28 Warrior-Lvl-28 Warlock-Lvl-29 Warlock-Lvl-26 Priest-Lvl-29	Warrior-Lvl-29 Warrior-Lvl-29 Warlock-Lvl-30 Warlock-Lvl-28 Priest-Lvl-30	Warrior-Lvl-29 Warrior-Lvl-29 Warlock-Lvl-30 Warlock-Lvl-28 Priest-Lvl-30	Warrior-Lvl-31 Warrior-Lvl-30 Shaman-Lvl-32 Warlock-Lvl-29 Priest-Lvl-32
Level of opponent mobs	Lvl 23-30 Elite	Lvl 33-34	Lvl 30-32 Elite	Lvl 33-44 Elite	Lvl 33-44 Elite
Media Length (min)	72	29	95	64	108
Number Wipes: Full/Partial	1/2	0/3	2/0	1/4	3/3
Number of Boss Fights	2	0	1	0	1
Number of Fights 1 Mob / 2 / 3 / >3	36 24/6/2/4	13 9/1/2/1	29 15/8/4/2	19 10/6/2/1	41 14/17/7/3

Table 3. Played instances

Case *Blackfathom Deeps (BFD):*

BFD is designed for teams with a level range between 23 and 30 and is populated by mobs with the same level range and ten different bosses. One of them appears randomly at the locations labeled with "6" in the map (cf. Figure 4). Eight bosses are distributed according to the labels ("1"-"5", "7"-"9"). "10" is the main, hardest too defeat boss.

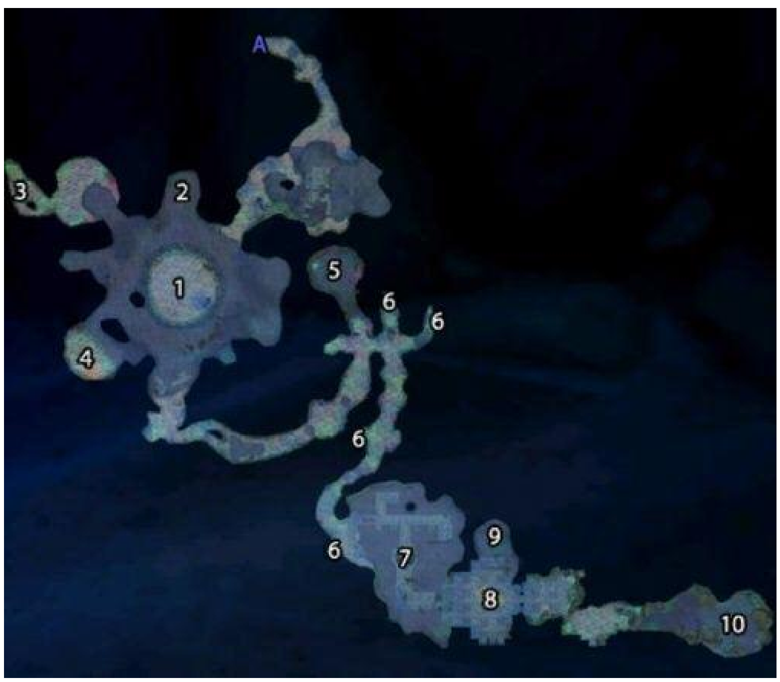

Figure 4. Map of Blackfathom Deeps

A run through BFD starts at the entrance ("A") and then the group proceeds from one boss to the next. The mobs are mostly mages and warriors and occur in teams of one to three mobs. The typical team strategy is to pull one mob out of the group (e.g., shoot on the mob from a distance), defeat this mob and proceed. This was the dominant strategy of the group in the instance to concentrate the capabilities of the teams´ characters towards the common goal.

The team – cf. Table 3 – had no problems standing all fights up to "8" (Figure 4). "8" is a great hall with an altar in the centre surrounded by four candles. The team was unsure how to entrance to "10". The idea to light all candles was discussed - no team member had knowledge about the situation. Each of the four team members lighted one candle resulting in the teams' distribution around the hall. Suddenly mobs poured into the hall, some team members tried to flee, some fought and the team went down (complete wipe). The warrior as tank died first, followed by the priest and the rest of the team without having the chance to coordinate teams´ actions. The lack of sensible communication illustrates the inability to coordinate (cf. Table 4)

Player	Statements
one	oh (00:00:59), nice (00:01:00), oh – yes (00:01:05), hahahaha (00:01:17)
three	no chance (00:01:28), oh my god (00:01:31)

Table 4. Chat chunks during the wipe

After the wipe and revival the team discussed the next attempt and developed a plan in which the warrior assigned the mob kill sequence. The plan was to pull only parts of the mobs into a safe area. In operation, the plan changed as the mob kill sequence was altered unintentionally and the team discussed during the fight to adopt some other strategy. This time the team was successful and proceeded.

Case *Entrance to Razorfen Kraul:*

Non elite mobs (level 33 – 34) populate the entrance area to Razorfen Kraul (Razor). The mob level was 4-8 above the team members´ levels, .i.e., mobs with four or more levels above players' level withstand most attacks and spells. E.g. a warrior cannot ensure that he successfully draws aggro and in case the mob withstands, the aggro eventually distributes on the whole team and to light-armored members that cannot absorb much damage. The team experienced such situations resulting in a high number of partial wipes since some members were able to flee.

There was another difficulty with this mob population. It was the first time the team was confronted with mobs healing each other. It turned out to be fatal that the mob that should be defeated first was healed and could not be killed by the team without running out of resources (health, mana, rage). After the first unexpected partial wipe, the team discussed intensively and developed a new strategy. It however took four attempts to bring down the mob group.

Analyzing the recorded video of the run, we found out that even after the successful attempt the team did not have a shared understanding about the situation with regard to who healed the mobs and which mob had which skills.

We observe phenomena in those fights that are interesting for virtual team research and underlines WOW's usefulness as experiment platform:

- We observe plenty of well-structured – sort of boredom causing – and few ill-structured really challenging problems for the team.
- Complexity and the need for intensive workflows arises from unexpected situations, groups of mobs leveled higher than the team and interacting groups of mobs.
- The change of plan necessary to cope with an unexpected complex situation was not possible. The group needs to have a plan beforehand.
- Especially in complex situations shared situational awareness (cf. Sect. "In time critical scene evaluation") was difficult to achieve and sometimes the lack of it caused wipes.
- Through rich communication and analysis between fights the team is able to establish a TMS rich enough to handle even complex situations – if not unexpected.

Lessons learned for experiment design:

- *To explore the development of TMS and shared situational awareness we need to record expectations and perceptions of the individual team members in critical fight situations. We introduced the concept of* in time critical scene evaluation.
- *Measurements for team performance could be: time for a run, resources as mana and health, damage, number of partial and full wipes and the use of communication means.*

VIDEO AND AUDIO RECORDING

"Real world" experiments always suffer from saving all data needed for analysis (e.g. observers are challenged to save their observations in real time). WOW offers the chance to record interactions as video directly streamed on each computer with "Realtime Video Capture Software" for example Fraps (www.fraps.com).

We decided to allow voice interaction in the team and employed Teamspeak (www.goteamspeak.com). The audio channel is recordable via Fraps or Teamspeak. A text-chat function is provided by WOW and loggable with an AddOn (e.g. Prat, http://wow.curse.com/downloads/details/7617/).

Lessons learned for experiment design:

- *One recording of all team members´ voice-chat is difficult to analyze. For transcription, all individual voices should be recorded separately.*

IN TIME CRITICAL SCENE EVALUATION

The case of Razor demonstrated the lack of shared situational awareness. This term reflects a dynamic process of perceiving and comprehending situational events with the goal to understand the situation in a mutual way and to obtain convergence between on the one side the view of all individual team members and on the other side the objective truth of a situation (Nofi, 2000; Alberts and Hayes, 2006). Awareness refers mostly to the understanding of others' activities (Dourish and Bellotti, 1992). With regard to WOW awareness and mutual understanding of the situation itself is at least as important as to understand the activities of the teammates.

To analyze the degree of shared situational awareness/understanding we design a questionnaire to be filled out by each team member after a critical scene and before discussing the scene. E.g. in our played instances we asked each team member to describe in case of wipe the causes. Table 5 gives examples of situations with a lack of shared situational understanding as the team members differ in assessing the causes for wipes.

Wipe	Player 1	Player 2	Player 3	Player 4	Player 5
1	The opponent fled and brought back more opponents.	It took the team too long to decide.	Too many opponents.	Too many Mobs occurred.	Too less damage produced by the team.
2	Warlock's slave pulled new opponents.	I pulled two opponents when running backwards.	Two unexpected opponents occurred.	Too poor visibility and too many Mobs	Poor visibility

Table 5. Individual wipes assessment

PROTOTYPICAL EVALUATION

As a prototypical demonstration of our approach's validity we present results from the Razor run analysis. The run includes fight phases (59 % - about 17 minutes) and recreation time (41% - about 12 minutes, necessary to heal between fights).

Appearance	Number of Opponents	Total Time (s)	Mean	Time per opponent
9	1	343	38	38
1	2	64	64	32
3	3	612	204	68

Table 6. Recorded Fights in the Razor run

13 fights with different classes of opponents were fought (Table 6). The team defeated nine times a single opponent that took on average 38 seconds. Three times a group of three opponents occurred and on average it took 204 seconds to defeat the group, i.e. 68 seconds per opponent.

Interestingly it took nearly twice as long to defeat the mobs when they occurred in a group of three. This has two reasons. Firstly, the splitting of resources defeating a group and secondly the opponents interacted as a "team" and fought together. Especially one mob healed the group of opponents. Both, the necessity to split resources and the opponent interaction increased the complexity of the task.

When we fought we neither chatted more nor less than in times of recreation. We transcribed 472 chat chunks with on average six words per message. We chatted 280 chunks whilst fighting (59 %).

Social-Emotional Area: Positive Reactions	1 Shows solidarity, raises other's status, gives help, reward	7 Asks for orientation, information, repetition, confirmation	**Task Area: Questions**
	2 Shows tension release, jokes, laughs, shows satisfaction	8 Asks for opinion, evaluation, analysis, expression of feeling	
	3 Agrees, shows passive acceptance, understands, concurs, complies	9 Asks for suggestion, direction, possible ways of action	
Task Area: Attempted Answers	4 Gives suggestion, direction, implying autonomy for other	10 Disagrees, shows passive rejection, formality, withholds help	**Social-Emotional Area: Negative Reactions**
	5 Gives opinion, evaluation, analysis, expresses feeling, wish	11 Shows tension, asks for help, withdraws out of field	
	6 Gives orientation, information, repeats, clarifies, confirms	12 Shows antagonism, deflates other's status, defends or asserts self	

Figure 5. The IPA Classification Scale (Bales 1950)

To analyze the communication and coordination patterns, we utilize the Interaction Process Analysis (IPA) (Bales, 1950). IPA was developed for face-to-face groups but is also used for virtual and computer mediated groups (Hiltz, Johnson and Agle, 1978; Rice and Love, 1987; Kanawattanachai and Yoo, 2007). IPA uses a classification scheme (Figure 5) that assigns each message a class (1-12).

	Contribution of Chat Chunks in %			
	Total	Recreation Time	Fight Time	Intensive Fight Time
Player 1	30,3	31,6	29	27,04
Player 2	15,9	15,8	16	16,84
Player 3	21,6	23,7	20	20,92
Player 4	13,3	12,1	14	16,33
Player 5	18,9	16,8	20	18,88

Table 7. The Contribution of Chat Chunks within the Group

Firstly, we are interested in the individual chat contribution (Table 7) within the team in several phases of the run.

We identified phases of recreation, fight and intensive fight (fight against at least 3 mobs), which is included in the time of fight phase. The overall ratio of chat chunks per time in phases of recreation and phases of fighting is approximately the same. Interestingly, the chat chunk per time ratio in intensive fight was higher than in normal fight. 70 % of the conversation during fights was done in times of intensive fighting. 60% of fight time is rated as intensive. In intensive fight communication increased.

Secondly, with increasing intensity communication participation was more even. In intensive fight times contribution per person was between 16% and 27%, in times of recreation between 12% and 31%. Intensive fights need intensive workflow patterns (cf. Sect. Literature Review) – observable in this setting.

Thirdly, we identify two team leaders (player 1 and 2). Player two was the assigned formal team leader – he had the small crown of the team founder. However, player two contributed only a low quantity of chat chunks in the whole run. The communication contribution of the talkative player one decreases the more intensive the situation got, notwithstanding his leadership role illustrated by examples in Table 8.

Player one:	"Yes the meat is that the Dot is at place." (04:33) "Mike, please place the Dot, so that he will not flee." (04:47) „Well, go on the lam… Kyra go on the lam with your shield" (07:25)

Table 8. Commands by player one

According the IPA-scale we code commands as category four (Table 9). The formal leader (Player 2) has the highest ratio of class four messages to his total messages.

	Chat Chunks coded as class four in %			
	Total	Recreation Time	Fight Time	Intensive Fight Time
Player 1	17,61	16,67	18,29	18,87
Player 2	28,38	30	28,89	21,21
Player 3	3,92	0	7,02	9,76
Player 4	3,17	8,70	5,00	6,25
Player 5	8,99	3,13	12,5	10,81

Table 9. The contribution of command messages

	Social-Emotional Area: Negative Reactions in %			
	Total	Recreation Time	Fight Time	Intensive Fight Time
Player 1	13,38	15	12,2	8
Player 2	9,46	13,33	6,67	4,35
Player 3	14,71	8,89	19,3	20,83
Player 4	39,68	26,09	47,5	44,44
Player 5	24,72	15,63	30,36	23,81

Table 10. The players' contribution of negative reactions

We observe that both leaders do not compete for their own sovereignty but implemented a shared mutual leadership behavior (Gronn, 2002; Carson, Tesluk and Marrone, 2007). We argue that in case of fighting, we would observe a high amount of what the IPA scale rates as negative socio-emotional reactions. In intensive fight phases the amount of negative socio-emotional reactions by both leaders was lower than in less intensive phases (Table 10). The contribution of negative reactions given by players three, four and five is higher in times of fighting than in recreation phases – they suffer stress. We can observe how individuals react to different workflow patterns and how teams adapt to different levels of complexity.

Lessons learned for experiment design:

- *IPA as analysis instrument for WOW teams´ communication provides valuable insights.*
- *Teams adopt communication patterns to levels of complexity and intensity of communication varies depending on intensity of fights and complexity of situation.*
- *Changes of workflow patterns are triggered by the level of complexity.*
- *We observed interesting leadership models.*

SUMMARY AND DISCUSSION

The objective of our research is to develop a research method to evaluate how virtual, synchronous teams perform and organize in complex tasks. We have analyzed only a limited number of runs of a single team and so the results on team performance are rather preliminary. Our research aimed at exploring a research method with WOW as an experimental platform. We hypothesize that WOW is a useful experiment platform. We explored that instances offer tasks of different levels of complexity and that we can vary complexity by choosing instances and characters different in level and skill sets. Furthermore the variation of team members regarding their experience in WOW gaming and the variation of communication means available for the team promise interesting settings to explore the workflow and coordination processes of virtual teams solving complex tasks.

We observed a number of interesting phenomena. The way WOW teams plan, organize and act raise interesting questions about establishing TMS, shared situational awareness and trust. Frequent frustrating wipes challenge teams´ cohesion and moral. We argue that communication needs to be professional and rich to succeed. We observed individual differences in communication and participation behavior, interesting leadership models that might be particular for virtual synchronous teams and adaption processes of teams to the complexity of their tasks.

We argue that WOW is a suitable experiment platform as the settings are controllable, the experiments are repeatable with a number of adequate measurement-candidates and infrastructure to collect data. Whether future results can be transferred to professional virtual team settings is to explore, what we consider as limitation. A beneficial aspect of WOW we observed in the course of our action research was fun. We expect plenty of research participants and hope for long-term studies.

We invite all researchers interested in our studies or interested in our videos of runs to contact us via seriousgaming@unibw.de.

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