Trans-Reality Gaming[1]

Craig A. Lindley
Institution Technology, Art and New Media,
University of Gotland, Cramergatan 3, SE-621 57 Visby, Sweden
craig.lindley@hgo.se

Abstract-Trans-reality games are games that take advantage of pervasive, mobile, ubiquitous, location-based and mixed reality technical infrastructures to deliver new modes of game play experience in which the different contexts of staging are integrated within a unified game space that crosses over technical borders. The development of trans-reality games involves meeting specific design challenges concerning variations between the roles of technology and the player in different game staging environments. The result must be a design methodology in which diverse demands upon and opportunities for player creativity are integrated within the mechanics of a specific trans-reality game design.

I. INTRODUCTION

Trans-reality games are games that combine virtual gaming with game experiences staged and played in physical environments, providing a fluid movement of the game experience through its various physical and virtual stages. There are a number of related concepts that it is useful to characterize in order to clarify the concept of trans-reality gaming. A *mobile game* is a game that takes *changing* relative or absolute position/location into account in the game rules. Strictly speaking this excludes games for which mobile devices merely provide a delivery channel where key features of mobility are not relevant to the game mechanics. A *location based game* is a game that takes relative or absolute but *static* position/location into account in the game rules. A *ubiquitous game* is a game that uses the computational and communications infrastructure embedded within our everyday lives. This is related to the concept of *ubiquitous computing*, which is concerned with embedding intelligence within everyday environments (eg. smart appliances and buildings). Ubiquitous games are games that take advantage of a ubiquitous computing environment. However, the term is also sometimes used to refer to pervasive games. *Pervasive games* have been defined as *"*game experiences that are tightly interwoven with our everyday lives through the items, devices and people that surround us and the places we inhabit." (see www.pervasive-gaming.org). Ie. they are games that pervade our daily experience.

Virtual realities are realities generated by computer systems. Hence the game worlds of commercial computer games are forms of virtual realities. VR research has had a strong focus upon closing the perceptual gaps between virtual worlds and physical worlds, incorporating, for example, stereoscopic viewing and haptic technologies. The commercial success of computer games has demonstrated that closing the perceptual gap is not crucial for highly engaged and immersed game play. However, *augmented reality games* and *mixed reality games* are an interesting approach to the creation of game spaces that seek to integrate virtual and physical elements within a coherently experienced perceptual game world.

Just as a trans-media game can be played across different media, a trans-reality game should be playable across different realities. Mobile, ubiquitous and pervasive gaming technologies are technologies by which a game system can be realised through a range of different physical staging spaces, and for integrating those physical realities with persistent or transient virtual realities. These technologies provide a facilitating infrastructure for trans-reality games. A trans-reality game in the strong sense, however, is not simply trans-medial in relation to this infrastructure (ie. it is not simply a matter of playing the same game via different devices). The infrastructure must support a coherent game world that integrates physical game space elements with virtual game space elements, and allows game play and components to move as "seamlessly" as possible through these spaces as parts of a single coherent game world. This means, above all, the preservation of the sense of identity of game objects (including characters) through their manifestation in different (physical and virtual) realities, the propagation of the significance of game actions and events through these realities, and game mechanics that weave those events into a coherent game concept. A trans-reality game is thereby an appropriation of elements of different realities into a single game. This is not necessarily a pervasive game, since the game context may not pervade life in general. Nor does it mean that players using different technologies and game spaces have the same interaction techniques or play modes (there may be different rules, for example, for different kinds of players and technologies). One of the greatest challenges for the development of design principles and methodologies for trans-

[1] Keynote Address, published in the proceedings of the Second Annual International Workshop in Computer Game Design and Technology, 15-16 November, Liverpool John Moores University, UK.

reality games is to understand the relationships between the functional roles of players and technologies, how these vary with different game staging technologies and scenarios, and how these variations can be integrated within games that involve different modes of physical, virtual and mixed reality game play within a single, coherent game concept.

This paper explores these iussues in relation to a model of the media-independent, or *trans-medial*, aspects of the form of game productions, together with a consideration of how media-specific realizations of a game create differences in the game play experience. This is a very preliminary investigation of these concepts, since few contemporary games approach the model of trans-reality games. However, ongoing research is targeting the further development of this form together with the articulation of design principles and methodologies for the development of true trans-reality games.

II. THE TRANS-MEDIAL FORMAL STRUCTURE OF GAMES

Many of the systems and experiences that are referred to as games include different kinds of formal systems as a basis for creating the player experience. The archetypal model for a game is a two-player board game. However, many computer games, and games that do not require computers such as table-top and live-action role-playing games, may include strong story or narrative elements as well as simulating game components within the game space, their behavior and their interactions. These distinctions are well recognized in the contemporary study of games. For example, Aarseth [1] began the serious exploration of the relationship between game play and narrative, while Frasca [5] has brought the discussion of the relationship between simulation and narrative into the sphere of contemporary computer game studies. Interestingly, games and simulation have always been closely associated, probably due to the archetypal interpretation of chess as an abstracted war game, and the more recent development of table-top war games as explicitly both games and simulations of warfare (see [14]). Carried into contemporary military practice, this is more than a metaphor, being an accurate description of the formal systems and methodologies at play in military exercises conducted with the use of real systems.

John Kim's "Three Way Model" uses a variation of the game/narrative/simulation trichotomy, formulated in terms of the approaches of the Gamist, the Dramatist and the Immersionist, respectively, as a description of the differing approaches of *players and game-masters* to the creation of play experiences in live action role playing games (see www.darkshire.net/jhkim/rpg/theory/threefold). Lindley ([9], [10]) has taken a more structural approach, examining the foundations of the distinction in differing principles for the creation of time structure by the *authors and designers* of a game system.

A.. Game

The structural approach is based upon an attempt to define games, simulations and narratives in a way that allows them to be distinguished in terms of both design principles and the resulting time structure of the play experience. A *game* is defined as *a goal-directed and competitive activity conducted within a framework of agreed rules*. This *ludic* or *ludological* definition of game is the kind of definition at the base of traditional game theory in disciplines like economics (eg. [3]). It also forms the basic abstract model of the individual challenges encountered by players of computer games. A computer game therefore contains many games by this definition.

The rules and ludic medium of a game imply and support a range of different types of valid actions, typically with scope for variations in how those actions are performed while still being valid, and how and when different actions are selected and sequenced. A *move* within a game is an abstraction over player action, mapping it to an abstracted action of significance within the rule set of the game and independent of local, personal and idiosyncratic variations in performance; a move is a connotation of a physical action allowed and facilitated by the framing of the game (I can move a chess piece on the board at any time, but I only make *a move* in the game of chess when I'm playing the game). Hence a player performs actions having conventional connotations as moves within the formal system of the game. Those actions are likely to be highly stylized according to the game, and actions too dissimilar to the stylized set will be regarded as illegal moves, interpreted as errors, fouls or cheats if their performer intends them to have in-game significance, or as *extra-ludic* actions potentially frustrating other players if they are not intended to have in-game significance.

Player engagement within a game experience is strongly associated with the choice and performance of game moves. The potential for choosing moves results in a very loosely predefined time structure such that games are not strongly a priori time-structured in their design. A specific type of move is likely to have some time structure at least implicit within the

rule-derived constraints bounding valid ways of performing it. But this is minimal, and the temporal structure of gameplay patterns is an emergent structure developed during play by a player. Even games like *Snakes and Ladders*, in which progress is a matter of very constrained movement across a highly structured grid, supports a very large space of possible combinations of moves on the board, corresponding to an equally large space of possible time structures (choice in this case being realized in the performance of an act having a probabilistic outcome, ie. the throwing of dice). For this reason, the purest examples of game form cannot be regarded as heavily time-structured artifacts. However, there are larger scale time structures specific to game form. These larger scale structures are reflected in the language of rounds, bouts, matches, tournaments, seasons and campaigns. The most primitive complete game experiences, at which a point of win or lose is reached, are bouts or rounds. Significantly, the higher level structures tend to be highly repetitive patterns of these simple game experiences. They are largely concerned with the organization of opponents, and extension of the simple competitive situation of a game to include a broader field of opponents with a view to obtaining a global performance or game play ranking obtained by accumulation of the results of many bouts. Some rather arbitrary working definitions of these higher level structures are:

- a *bout* or a *round* is the single performance of a game between opponents resulting in a win/lose state[2]
- a *match* is a series bouts or rounds of the same game between the same opponents
- a *contest* is a series of rounds of different games between the same opponents
- a *league* is a series of rounds of the same game between different opponents
- a *tournament* is a series of rounds of different games between different opponents

These structures may be nested in hierarchies, lattices or networks. For example, performances within a tournament may each have the form of a match. High level game structures have their own rules, these being the rules for accretion of the results of bouts and rules for matching competitors in ongoing events. A multi-game structure requires a *principle of accrual of results*. That is, various formulae may be used for accumulating wins and loses, and degrees of win/loss, into an overall competitive ranking, or for the identification of a set of *champions* across various categories. The structure may also include *elimination events* in which losing competitors are eliminated from further competition, or the game system may include *principles of handicap* by which differences in demonstrated game play expertise are compensated for to provide for less predictable outcomes in ongoing competitions.

These are match, contest, league and tournament rules that have no impact upon low level game rules or the abstract form of moves within each specific game type. The time structure among these higher level game groupings is incidental to the essential performance of the players. Even more strongly, it can be stated that the high level structures of game forms have little to no dependence on specific time orders. Their primary meaning is the ranking of player competence; time-ordered competitions are a convenience for identifying this ranking. In principle it doesn't matter at all what the sequencing of competitions is, as long as it leads to an order of player competence (hence the common freedom to choose the sequence in which one defeats one's opponents in a computer game level). So at this level too, games are not primarily time-structured designs, and the high level time structure does not impinge upon low level game rules or the basic experience of play. This is a critical distinction between the temporal form of games and those experiences that have a strong a priori story or plot structure created by their designer. In many computer games, instances of combat are individual bouts (these are experiences of playing single games, by the definition above), while levels may be seen to be organized as a series of matches, contests, leagues or tournaments. If a higher level game structure is designed to present players with a specific sequence of game experiences, activities and opponents, serving to shape the emotional tone and intensity of the experience, the form is starting to move away from pure game form, more strongly integrating variants of authored narrative as manifested in the prespecified plot design.

B. Narrative

In contrast to the ludic structures of experience within a game, *narrative* in the strongest sense is perceived when a structure conforms to a very specific narrative pattern (the kind of narrative schema referred to by Douglas and Hardagon [4]). An a example of such a pattern, commonly found both in commercial cinema in computer games, is the *three-act restorative structure* (see [2]). The three-act restorative structure has a beginning (the first act) in which a conflict is established, followed by the playing out of the implications of

[2] There may be more than two opponents, and each opponent could either be an individual or a group; opponents may also be synthetic, eg. the NPCs of a computer game.

the conflict (the second act), and completed by the final resolution of the conflict (the third act). The three-act restorative model includes a central protagonist, a conflict involving a dilemma of normative morality, a second act propelled by the hero's false resolution of this dilemma, and a third act in which the dilemma is resolved once and for all by an act that reaffirms normative morality. Each act within the three-act structure culminates in a point of crisis, the resolution of which propels the plot into the following act, or to the final resolution. This structure is very common and highly immersive for audiences having strong anticipations of the structure's definitive elements.

In computer games incorporating a prespecified three act restorative structure, the central conflict form often manifests recursively (ie. the structure is repeated at different levels of temporal scale). For example, the overall restorative three-act model may be applied to the game experience as a whole, with the dramatic arch being completed when the user finishes the game. At this level the story is usually not interactive, since act one, key scenes within the story of act two (ie. primary plot points), and the playing out of the consequences of the final resolution of the conflict in act three are typically achieved by cut scenes, sequences of non-interactive, pre-rendered video or non-interactive animation sequences. The next level down within the recursive structure is that of the game level. The game level is designed for the pursuit of a goal, that of the player reaching the end of the level, which progresses the player through the second act of the higher level three-act structure of the game narrative. There is rarely if ever a one-to-one correspondence between game levels and acts; more typically, the first act and the end of the third act are presented via cut scenes, with playable game levels summing to form a highly extended second act followed by the final resolution of the third act as the end of game play (eg. by overcoming the final and toughest enemy, usually a demonic character at the heart of the central conflict in the story). Although experience within a level typically has much of the structure of a match, a contest, a league or a tournament, the sense of level-specific narrative development can be enhanced by increasing difficulty through a level, or by an internal dramatic structure that emphasizes the point of completing the level, such as the defeat of a level boss, the big barrier creature at the end of the level. The false resolution that drives act two of the three-act restorative model at the highest structural level may be seen manifesting recursively with each game level: when the game level is resolved (completed), the player finds themselves at the beginning of the next game level full of conflicts.

At the next level of the recursive decomposition of game structure, there is often a series of smaller scale conflicts and challenges within a game level, which may include monsters to be defeated or avoided, puzzles to be solved, or treasures, clues or keys that must be found in order to progress in the current or future game levels. Usually it is only this lowest level of the game plot that is highly interactive; these are actually the individual games played by the player (by the definition given above). The linear and non-interactive cut scenes framing game play are revealed in a predefined order, and within a level all players usually start in the same place and must have completed the same set of tasks in order to complete the level. The low level and interactive parts of the game are played by performance of a repetitive pattern of moves by which the player progresses through the individual games of a level. Hence for computer games, game play usually has little if any bearing on the story being told; the story is for the most part a structure imposed on top of, and different from, game play. This poor integration of narrative significance with game play is usually far less of a problem for table-top and live-action role-playing games. While tha latter may use highly mechanical rule systems, as Mackay [11] observes, over a long playing time (eg. months of weekly sessions) the rules sink into the background of the experience and the player-created characters and stories become richer, deeper and more the point of the experience. For computer games, however, although the machine handles the details of implementing the rules, the communication channels between players are highly limited compared with those for table-top and live action roleplaying games. More than this, however, players have no ability to influence the nature of the world, its non-player characters (NPCs) and its predefined story or plot elements. Table-top games and LARPs involve players as co-authors of the world and it's history, with game-masters constantly incorporating player-generated material and ideas into ongoing scenarios (especially in the case of table-top RPGs). Computer game players are much more limited to the reuse of narrative fragments provided for them by the game developers. This point is further elaborated below.

C. Simulation

A simulation can be defined as: *a representation of the function, operation or features of one process or system through the use of another*.

Computer games are heavily based upon simulation, particularly the perceptual manifestations of game objects, their behavior, the game space and/or environment, and systematic

interactions between game elements. Established simulation techniques may be used. Methods from discrete event systems simulation include stochastically modeled arrival and service processes, queues of various kinds, networks interconnecting these elements, and response behaviors of simulation objects to queues such as balking, reneging, and jockeying. Simulation of physical game world characteristics involves continuous systems simulation of the motion and physical interactions of game objects based upon kinematics and dynamics, having a verisimilitude based upon sample (or simulation) rates (ie. frequency of time cycles) and quantisation accuracy (ie. the number of bits used to represent a continuous phenomenon, like a length, distance or mass).

In games simulation extends to the simulation of cognitive and emotional states and behaviors of game characters. While this has been a general goal of AI research, in games the issue is one of achieving interesting aesthetic functions of game characters; hence games require what Matteas [12] refers to as *expressive AI* in addition to any concerns they may have with the simulation of general forms of decision making or emotional affects.

For game worlds, it must be possible for the simulation model to be a model of a system or world that is a fiction or *fabrication*. In ludic systems, some systems are simulations in the strict sense (eg. flight simulators), but the simulative aspects of most ludic systems are very limited. For example, most interactive 3D ludic systems simulate a three dimensional Newtonian world having a uniform gravitational field. Beyond that they may be just about completely fabricated, presenting a model of a fictional world and its contents for which the question of correspondence to any perceived external reality is mostly beside the point.

A model-based ludic system may involve none of the repetitive goal-oriented activities characteristic of game play (there may be no obvious end state, other than the player getting bored), and none of the specific predefined patterns in time or generative foundations for predefined temporal patterns (above the object level) characteristic of narratives. Time patterns emerge over the course of running a model, can be completely different for different runs, and may never have been anticipated by the designers of the model. Repetitive action may be used to operate a model, but may not be directed to any specific overall goal by the player/operator.

It is interesting to regard single player strategy games from the simulation perspective. During competitive play, there is an obvious goal. But many games allow players to continue playing after all of the enemies are defeated. Until resources run out, these games may then run indefinitely modeling a simple economic system. There is no more game play by our strict ludic definition, and the narrative after winning has no interesting temporal (dramatic) structure unless the players invent one. Models having a strong simulation function, like flight simulators, are often interesting from the perspective of skill development; they are not interesting as games or stories, but for understanding how a particular system functions in different circumstances. The extent to which a ludic system is a model is reflected in the ability of players to define their own narratives, temporally structured experiences and/or games and game systems within the modeled world. In this sense a model provides a *field of play*, within which it is up to the players to define how they will play.

D. Interrelating Games, Simulation and Narrative

The treatment of games, simulation and narrative above reflects a different emphasis in the way time is structured for each of the forms. Each is defined in a different way and also reflects a different intellectual tradition together with different tools and methodologies. Each approach can form a different lens for viewing a game system and the forms of play experience that it supports. However, the differences are deeper than this. Each form emphasizes a different time scale for designing and structuring a game and its associated play experiences. For contemporary interactive 3D computer games there is also an existential dependency between the forms. The *simulation level* is concerned with the smallest scale of time structure: it requires the design of rules for determining what the state of the game world will be at a given simulation time tick based upon the state of the game world at the previous tick together with the inputs to the world. This is the level at which the position and velocity of a projectile are determined at a particular point in simulation time based upon its position, velocity, mass, and influencing forces at the previous time step.

The *game level* is the level at which a game is formally defined. This includes game objects or components needed to play a game, the rules of play, a game space in which a game may be staged, and a set of game moves together with conditions for their validity. For a computer game, this is a level of structure imposed *on top of* the simulation level. The user interface provides player interaction possibilities (eg. select a button, a game object or a place within the simulated game space using the cursor and a mouse click) that are mapped onto game moves at the game level. Examples of game

moves include “select a target”, “fire a weapon at the target”, “move to point (x,y)”. Game moves may be implemented as phenomena triggered at the simulation level. The move “fire a weapon at the target” may involve triggering a missile fired at a selected target, the flight of which is then simulated beyond the immediate control of the player as a tick-by-tick ballistic motion, as described above. While game moves and actions may be simulated actions and events, they are events that take place within a special context of significance, which is *the game*, and it is the game that specifies what marks the beginning or end of a move and the significance of the simulated events in terms of the competitive situation and payoffs of the game. The game as a system specifies a typology of significant events (moves) and rules for their application and significance (when they are allowed and what are their consequences, respectively). For games that are not computer games, the simulation level still exists. In these cases it might be more accurately called a performance or fabrication level, which might also function as a simulation. Eg. LARP combat rules allow players to simulate combat by performing actions in the real world. There is a fundamental ambiguity here, however, as to whether performed actions either are or simulate the actions in question, a perennial and interesting question for LARPs in general and one closely related to their liminal power (an issue explored by many LARP theorists; see [13]).

The narrative involved in a game is a high level shape of the experience, and especially one having a specific form of development leading from a recognizable start point to a recognizable end or point of closure. Game structures such as matches, tournaments and competitions do provide a form of high level structure constituting a weak form of narrative. This is in contrast to strong forms of narrative that have more specific requirements in terms of how events develop over time and how characters are involved in this pattern of temporal development. The simulation level of a game provides the foundations for the *diegesis*, or represented world, of the narrative. Game moves provide a version of what Mackay [11] refers to as *fictive blocks*, basic fragments or units of fictional/narrative significance that may be strung together to form a higher level narrative. Mackay takes fictive blocks divorced from their original context to be equivalent to Schechner’s *strips of imaginary behavior*, patterns that constitute a repertoire of potential behaviors that are performed by an actor in new arrangements in ways that may appear spontaneous and unrehearsed. Fictive blocks derived from popular culture sources (films, television, literature, etc.) are understood to circulate broadly within a culture, where they are available for reappropriation by its participants for the creation of new narratives (novels, movies, role playing game play sessions). In the case of a computer game, fictive blocks have a tangible and predefined form created by the game authors as the constrained set of valid game moves that the player may choose at any particular point in the unfolding play experience. As mentioned above, the play experience may also be framed by a high level narrative context, determined by the system designers and often based upon a three-act model of narrative structure. The integration of this high level structure with the low level fictive blocks provided by game moves may be done more or less well in a particular game design (ie. unlike table-top and live action RPGs, it is not up to the players of a computer game to achieve this). Poor integration, or the definition of moves that emphasise repetitive game play, may lead to the perceived tension between game play and narrative explored by Aarseth [1] and attributed by Lindley [8, 9] to game forms that encourage repetitive and even trance-like modes of game play not linked to any strong ongoing narrative significance.

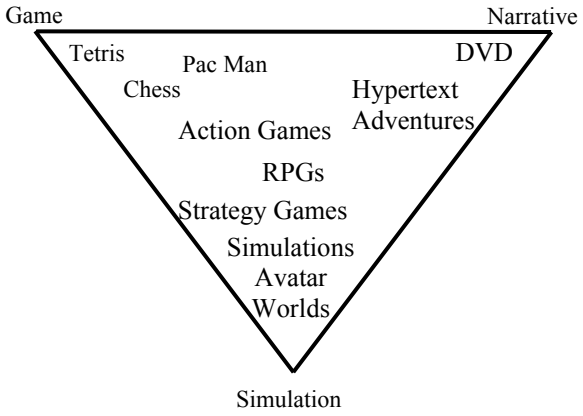

Fig. 1. A game classification space.

As depicted on Fig. 1 (and proposed in [9]), the game, narrative, and simulation forms can be used to create a classification plane upon which specific games or genres might be placed as a heuristic guide to which of these forms has the most influence in the perception of the kind of experience the player is having. There are many strategies by which these formal elements might be integrated. In general, however, they map out the space within which computer games fall, constituting what has previously been labeled as *ludic space* [10]. These are also the formal elements most likely to be trans-medial, ie. transferable across different media while still preserving a sense of being *the same game (or narrative, or model, or game/narrative/model)*. In addition to these formal characteristics, concerned with principles for structuring the game experience in time, there are additional distinctions to

take into account concerning the *representational function* of a ludic production, and concerning its status in relation to computational media.

E. From Fiction to Non-Fiction Games

Here representational function is understood in terms of the degree to which a ludic production represents a fictitious world in in comparison with the degree to which it represents or constitutes a factual world. Since this represents a range of variation between two extremes, the basic classification plane shown above can be extended into a classification space, as shown on Fig. 2.. The result is a three dimensional triangular prism in which we can classify games according to the degree to which they involve game, narrative and simulation, and also to the degree that they involve a fictitious world. In this space we can place team sports and game shows as highly game-informed experiences, but with no creation of any kind of fiction. Adventure sports, like mountain climbing, caving and scuba diving are similarly non-fictional, but have more of the nature of narratives than of games, being structured in time, usually not competitive and having rule structures concerning safety rather than constituting arbitrary game rules.

Military vehicle simulators lie strongly at the simulation extreme, but combine elements of both real and fictitious worlds. The fiction is realized by imaginary (ie. simulated) components like enemy vehicles and battlefields, while the non-fiction elements include accurate functional modeling of real systems, and the use of physical vehicle models as interaction and staging technology.

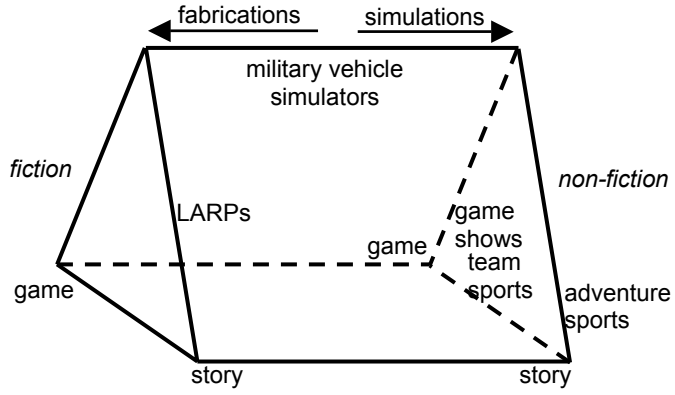

Fig. 2. The classification space extended to include a continuum from fictional to non-fictional representation.

Live action role-playing, or LARP, games involve players performing game characters in physical space. LARPing may be more or less game-like, depending upon the degree to which players use rule sets. But most of the experience is a form of improvisational theatre in which the players are also the audience. Hence LARPing tends to be highly fictional, and lies between simulation and narrative with a variable game aspect to the experience.

F. From Virtual to Physical Games

The last main classification dimension to be considered here is that from virtual to physical gaming. By virtual gaming we mean games that have most of their mechanics processed within a computer and have their audiovisual content delivered by computer peripherals, rather than being played out and experienced in physical space. The continuum between virtual and physical gaming, like the fiction to non-fiction continuum, can be represented as the third dimension of a classification prism, as shown on Fig. 3.

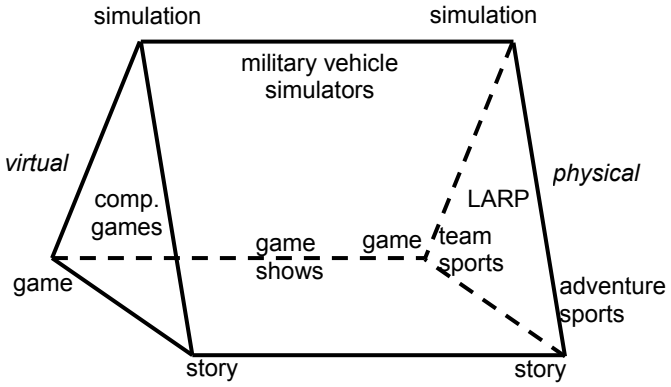

Fig. 3. The classification space extended to include a continuum from virtual to physical.

Sports games by this definition are very much at the physical extreme, while current computer games are predominantly virtual. New forms of location based and mobile gaming combine both virtual and physical gaming, often using a computational and mobile infrastructure to support game play action in the real world.

Only a small number of technology based games have been developed that use real-world location as a significant factor in gameplay. An example is Botfighters, developed by the Swedish mobile-games studio It's Alive!

(http://www.itsalive.com/page.asp). The game tracks GSM-cell locations and allows players within range of each other to score kills and gather resources to buy upgrades.

Portugese company Ydreams have recently launched a Botfighter-like anti-terrorist game introducing the concept of physical sanctuary in certain locations, such as malls and restaurants.

The projects Can You See Me Now and Uncle Roy All Around You, created by the UK mixed-reality performance group Blast Theory (http://www.uncleroyallaroundyou.co.uk/), both use handheld computers, GPS location tracking, and invisible online players to construct games where fast physical movement and device-mediated teamwork are central to gameplay.

These are some of the first games to use location and mobility significantly in game play, rather than simply delivering games by mobile devices that could just as easily be played on fixed position PCs. Can You See Me Now and Uncle Roy All Around You are also early examples that can be categorised as trans-reality games.

III. FROM TRANS-MEDIAL GAMES TO TRANS-REALITY GAMES

The game/narrative/simulation model of computer game form creates a particular kind of play experience. While these elements of form may be trans-medial, actually transferring them to a different medium can have a radical impact on the nature of the play experience, depending upon the game. It may be that the player of chess does not have a deeply different experience of the game whether it is played using physical pieces on a board or using a computer; the abstract problem solving and pattern perception processes that engross the player are the same. But the experience of playing chess is strongly determined by what Zimmerman and Sahlin [15] call the *constitutive* rules of the game, ie. those rules that are specifically trans-medial. The *operational* rules of chess, ie. those determining how it is to be played in a specific medium, have a weak impact upon the play experience. This is certainly *not* the case with many other games. For example, sports games realized on a computer may preserve the abstract problemmatics of the game, but totally change the experience of play, completely eliminating the dominant experience of a physical performance.

Trans-reality games are games that explore various combinations of physically staged and virtual gaming. This requires some very careful analysis and design, requiring not only the definition of trans-medial, or internal, principles of a game, but also identification of the operational rules required across the various media of the trans-reality infrastructure. Trans-reality games seek to integrate the play of players using different interface and access technologies within a coherent game experience. Thus the identification of how play differs when different media are used is only the starting point of design. The crucial design task is then to design a game world and game mechanics in which these differences are integrated, to create a coherent game experience for players who may be interacting via different technologies, and also players who may move between different play and interface technologies and scenarios *between* play sessions or even *within* a single play session.

IV. A CONCEPTUAL EXAMPLE OF THE DESIGN CHALLENGE FOR A TRANS-REALITY ROLE-PLAYING GAME (TRRPG)

An example of a trans-reality role-playing game (TRRPG) can be considered to illustrate the kind of design considerations that uniquely arise in the context of trans-reality games.

Role-playing games (RPGs) generally originated with table-top RPGs deriving from the very first commercial example, Dungeons and Dragons (TSR), first released in 1974. Since then table-top RPGs have developed through many variations of structure, genre, mechanics and style (see John Kim's characterisation of the development of RPG fashions at: http://www.darkshire.net/~jhkim/rpg/theory/fashions.html). Some of those variations include variations along dimensions from heavily dice-based, simulation-intensive play to dice-free play; from meandering time structures to structures based upon a specific sequence of acts, scenes and/or plot points; and from high level genres to RPGs based upon specific literary (etc.) works. RPG play scenarios vary from single play sessions that may go for a couple of hours, to repeated game sessions extending over many years.

A closely related development to the table-top RPG is the live-action RPG (LARP), a form of RPG in which the players more completely perform their characters within the RPG scenario, including the use of costumes and staging games within a suitable physical setting (see [6] and [13]). Many forms of LARP derive strongly from table-top RPGs. In fact, the rule systems of LARPs may be almost identical to those of table-top RPGs, aside from the variations introduced by dramatically performing characters rather than narrating their

performances (see, for example, the highly mechanical and unnaturalistically performed combat simulation rules and procedures of *Rules to Live By*, [7]). In general, LARPs are staged within specifically bounded spaces (eg. within a house, a submarine, an underground chamber, or a forest) and times (eg. one to three days).

Computer games have used many features of table-top role-playing game systems, with some computer RPG games being explicitly based upon specific table-top RPG systems (eg. BioWare's *Baldur's Gate* is based upon TSR's Advanced D&D table-top RPG game system).

It is possible for a particular role-playing game system to be used for table-top RPG play, LARPing and within the core game mechanics of a computer RPG. An RPG *system* is trans-medial in this sense. It might not be unreasonable, therefore, to aim to design a trans-reality game based upon a common game system. The trans-reality RPG (or TRRPG) might then seek to integrate:

- computer-based players using PCs or consoles playing in a context based upon a persistent virtual game world, as provided, for example, by commercial massive multiplayer role-playing games (MMORPGs).
- table-top role players, perhaps using miniatures (ie. miniature figurines representing game characters).
- LARPers.

It is assumed that technological systems supporting game play can be integrated, at least using a simple infrastructure based on off-the-shelf technology. This could include:

- a PC-based MMORPG system having interactive 3D PC clients linked to centralized game world servers.
- mobile access to the server system via mobile telephones, PDAs, and laptop computers with wireless connections.
- positioning devices such as Bluetooth, GPS and GPRS used to locate mobile devices or other game objects.
- instrumented table-top environments based upon table-top RPG play using miniatures, in which information can be fed back into the overall system, including character positions in relation to other characters and (virtual and/or real) objects on the table; it may be assumed that additional information typically held by players and game-masters (or GMs) is also input to/output from the system, such as character statistics, weapons, enemies and the like. The table-top environment might also include an active display, such as top-down projection of computer generated data.

This technical scenario represents a feasible and relatively inexpensive contemporary infrastructure for trans-reality gaming. However, the game design task is non-trivial. In particular, it is necessary to take into account some fundamental differences in the nature of the RPG play experience across the different media involved in the game forms from which the trans-reality RPG is to be evolved. Without entering into the development of design solutions for these challenges, some of the aspects that must be taken into account include:

- different time scales of games and play sessions. Dedicated MMORPG players may play for dozens of hours per week with a pretty regular time schedule for up to two years or more. Dedicated table top gamers might meet for several hours per week for two or more years. Dedicated LARPers might spent three days to a week in a single LARP game, and there are some recurrent games that run for this kind of duration, eg. with one session a year for many years (for a long-running LARP and system of connected smaller scale scenarios, see www.lorientrust.com). In addition, mobile players may have much more erratic play schedules, with short-term connections occurring with high frequencies. These time patterns do not naturally mesh together, so methods must be devised for integrating and taking advantage of these different time patterns within a single coherent game design.
- different scope for the elaboration of characterization and story on the part of players. For table top and live-action RPGs, rule systems provide the simulation substrate for game play and story, but players have much greater freedom than MMORPG players for the creative elaboration and deepening of both characters and story. LARP and table top player perform dramatically and as storytellers or narrators, having access to a vast range of fictive blocks recirculating within their culture, as well as having freedom for the artistic elaboration of meanings. The limited mapping of interaction options onto a fixed set of fictive blocks (game moves) in computer games greatly limits this creative potential. For a trans-reality game, however, some means must be devised for a game character to move between the physical and virtual contexts, assimilating without "shedding" its player-generated depth and complexity, or in such a way that the game somehow takes advantage of the different character manifestations. Virtual characters must also be able to interact effectively with physical characters in real time while taking advantage of the differences in expressive bandwidth afforded by the different but integrated performance modes.

Whatever the design approaches adopted, it is certainly not necessary to regard a trans-reality game as something that must

absorb unchanged the play patterns of its antecedents in table-top, LARP and MMORPG role-playing. Trans-reality gaming represents a new form that must evolve beyond its precedents. This may mean the creation of new time patterns for integrated play via different access technologies and game stages.

V. CONCLUSION

This paper has characterized trans-reality games in relation to pervasive, mobile, ubiquitous, location-based and mixed reality games. These latter forms have been seen to provide a combined technical infrastructure for the realization of trans-reality games. A defining feature of a trans-reality game is its provision of play experiences that *move through* this infrastructure, not merely in a way that hides the differences in the play experience supported by these various technologies, but in ways that take advantage of those differences and weave them into a coherent game concept with its supporting play mechanics. Trans-reality games are a new concept in gaming. The University College of Gotland and the Interactive Institute in Sweden have formed a joint project, the Trans-Reality Game Laboratory (TRGL), to explore, develop and demonstrate concepts and methodologies for trans-reality games. This project is an ongoing development of previous research work in the fields of computer games, location-based games and live-action roleplaying games, and is also integrated with the activities of the new EU Integrated Project on Pervasive Gaming (IPerG; www.pervasive-gaming.org). While this paper has presented the concept of trans-reality games, discussed a conceptual framework for their analysis and considered some specific design issues in relation to trans-reality games, no specific design solutions have been presented or described. Indeed, the articulation and demonstration of trans-reality design principles is the defining research agenda of TRGL and will drive the core of its ongoing research programme.

REFERENCES

[1] Aarseth E. J. *Cybertext: Perspectives on Ergodic Literature*, The Johns Hoplins University Press, 1997.

[2] Dancyger K. and Rush J. *Alternative Scriptwriting*, Second Edition, Focal Press, 1995.

[3] Davis M. D. 1970 *Game Theory: A Nontechnical Introduction*, Dover Publications Inc..

[4] Douglas J. Y. and Hargadon A. 2001 "The pleasures of immersion and engagement: schemas, scripts and the fifth business", *Digital Creativity*, Vol. 12, No. 3, pp. 153-166.

[5] Frasca G. *Videogames of the Oppressed – Videogames as a Means for Critical Thinking and Debate*, Masters Thesis, Georgia Institute of Technology, 2001.

[6] Gade M., Thorup L and Sander M. (eds.) 2003 *As Larp Grows Up: Theory and Methods in* Larp, Proceedings of *Knudepunkt 2003, www.iki.fi/hoh/meilahti*

[7] Kilgallon K., Young M. and Antunes S. *Rules to Live By*, Interactivities Ink Ltd., 2001.

[8] Lindley C. 2002 "The Gameplay Gestalt, Narrative, and Interactive Storytelling", *Computer Games and Digital Cultures Conference*, June 6-8, Tampere, Finland.

[9] Lindley C. A. 2003 "Game Taxonomies: A High Level Framework for Game Analysis and Design", Gamasutra feature article, 3 October 2003, http://www.gamasutra.com/features/20031003/lindley_01.shtml.

[10] Lindley C. A. 2004 "The Semiotics of Time Structure in Ludic Space As a Foundation for Analysis and Design", *Game Design Research Symposium and Workshop*, 7-8 May 2004, IT-University, Copenhagen, Denmark.

[11] Mackay D. 2001 *The Fantasy Role-Playing Game: A New Performing Art*, McFarland & Company, Inc., Publishers.

[12] Mateas M. 2001 "Expressive AI: A hybrid art and science practice", *Leonardo, Journal of the International Society for Arts, Sciences, and Technology*, 34 (2), 2001, 147-153. Available on-line at: http://www-2.cs.cmu.edu/~michaelm/publications/Leonardo2001.pdf.

[13] Montola M. and Stenros J. (eds.) *Beyond Role and Play: tools, toys and theory for harnessing the imagination*, Ropecon ry, Helsinki 2004.

[14] Perla P. P. 1990 *The Art of War Gaming*, Naval INstitute Press.

[15] Salen K. and Zimmerman E. 2004 *Rules of Play: Game Design Fundamentals*, The MIT Press.