H2020 Grant Agreement No 732332

D2.1 Systematic Review and Methodological Framework

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1. Executive Summary

This deliverable is the output of activities pertaining to the first two scientific tasks of the Gaming Horizons (GH) project: Task 2.1: Rapid, systematic review of evidence, and Task 2.2: Definition of a methodological framework. In the document, the methodological framework and its development are reported first because this informs the way activities in Task 2.1, and other project tasks, are carried out.

Based on the Grant Agreement (GA) and taking into consideration the project scope and objectives, the GH methodological framework is defined in Section 3 as comprising two main components: a conceptual component and a methods component.

The conceptual component identifies a multidimensional space for project activities and results. The dimensions of this space are the perspectives from which gaming and gamification are studied in the project, the different types of games considered in the study, and the different project stakeholders addressed. More specifically, the main project perspectives are the three academic perspectives of education, psychology and ethics, plus a professional game development perspective offering a practice-based sociocultural and artistic view of the world of gaming. The GH project considers both games and gamification where these comprise a digital component. The scope covers gaming as entertainment and also dedicated to purposes other than entertainment (applied games). The main project stakeholders, who are both sources of information and the target of project results, comprise game developers, educators, researchers, game users and policy makers. Underpinned by this framework, all project activities will thus contribute to the formulation of recommendations for its various stakeholders, striving to maximise coverage of each dimension.

The methods component of the framework focuses on the data collection methods adopted in each project task. These are sketched out in general terms in this deliverable, because they are to be specifically defined within each task; in-depth description will be provided in the respective project deliverables, as is done in Section 4 of this document for the literature review. More generally, the project methodological framework is not carved in stone, but rather provides a general guideline to be dynamically adjusted throughout the project, as also stated in the GH Grant Agreement.

Section 3 of this deliverable provides details about the method adopted and the results yielded by Task 2.1: Rapid, systematic review of evidence.

For the three main academic perspectives the approach adopted was based on the classical literature review procedure; some adaptations were applied as the very wide scope of the project resulted in the identification of an extremely large corpus of documents. After the definition of targeted queries, the two main scientific literature databases (Scopus and Web of Science) were searched to extract two datasets of relevant documents for each perspective, for a total of six datasets containing a total of 10,579 items. These datasets were then automatically filtered on the basis of citations: only publications with a number of citations one standard deviation above each year's average were retained. Subsequently, duplicates resulting from the multiple queries were removed, thus reducing the total number of documents to 674 items. Finally, the documents were manually screened with project-specific inclusion criteria (based on reading titles, abstracts and keywords) and the dataset was further reduced to 309 documents. Since this size was still unmanageable in the timespan available, a further phase of manual selection was carried out to identify literature reviews and meta-analyses; this step resulted in a set of 47 documents. These were analysed and coded using a specifically designed coding schema; the papers were categorised by perspective, gaming category and type, scope of the study, methodological soundness, and explicit or implicit recommendations for the various types of stakeholders considered. The unfiltered set of records generated from the initial queries was used to produce a keyword map for each perspective. The intention in this case was to identify the main topics dealt with in the original datasets and their interrelations, thus giving the research group guidance for integrating the final set of 47 literature reviews and meta-analysis with papers covering underrepresented topics. As it turned out, this method worked for the psychological and ethical perspectives but not for the educational perspective, where the keyword map was very intricate and did not produce any meaningful aggregation of keywords in clusters. In any case, the results of the literature review reported in this document are mostly based on the core literature reviews and meta-analysis identified with the above described method, plus additional references retrieved from the previous steps and, in some cases, by ad-hoc searches for relevant documents. As for the fourth, practice-based sociocultural and artistic perspective, the

approach adopted was radically different. Given the aim of providing a panoramic view of the cultural, social and technological implications of gaming, this part of the review is a survey of seminal, ground-breaking games based on expert developer knowledge of the field. The selection of these games was carried out by three experts and discussed with industry representatives, researchers and game developers with solid experience in the field, based on criteria such as social, cultural and technological impact on the history of games and significant interactions with the wider society.

As to the results of the literature review, these are reported in sections 4.4, 4.5, 4.6, 4.7, and 4.8. They are articulated in terms of a first section on quantitative data from coding, and one section for each of the four perspectives.

Until recently, literature reviews and meta-analyses concerning the educational potential of games have been rather cautious in their conclusions, possibly because empirical evidence usually regards the use of a single game in a given context, and results cannot be generalised to any game in any context. However, Clark et al.'s (2016) extensive meta-analysis suggests that evidence in favour of a positive learning potential of games is now more solid, and it also shows that there are several moderator variables increasing the effect, such as game mechanics, visual and narrative features, and additional instructor support. The analysis of the core papers for this perspective revealed that research has mostly concentrated on game based learning in the different disciplines, in the various types of games (with particular emphasis on immersive ones), and on the type of learning impact. This very varied landscape, together with the relatively narrow scope of empirical evidence, makes it difficult to draw general conclusions. It is perhaps for this reason that authors tend to agree upon the fact that research should focus more on the connection between games features and learners and content characteristics. As far as recommendations are concerned, collaboration between developers, researchers and teachers in game design is advocated by many authors. The alignment of game aims, mechanics and strategies, and content to be learnt is another important principle; another is that immersive gaming features should be used with care, in order to avoid unnecessary cognitive load. Finally, the pivotal role of educators in contextualising the gaming experience is underlined by several authors.

Analysis of studies within the psychological perspective revealed high-quality research on addiction, on cognitive benefits of gaming, and on motivation and

engagement, while studies concerning exergaming and the rehabilitation of older adults were lower in quality. In contrast with studies in the educational perspective, most of the psychological studies examined regard games as a whole rather than individual games, or even as part of a broader range of media. This leads to a relative lack of evidence on the impact that specific game mechanics and player characteristics may have on motivation, cognitive benefits and potential adverse effects. Finally, most of the recommendations emerging from the study of this perspective address researchers, and to a minor extent health professionals. This reveals, in our opinion, a certain distance between academic researchers in this area and the other stakeholders of GH.

The majority of the studies concerning the ethical perspective regard violent video games and their consequences on players' aggressive behaviour – a highly controversial topic that continues to attract media attention. The several meta-analyses carried out on this topic obtained contrasting results, probably due to differences in focus and methodology, and possibly also to a fuzzy definition of the concept of "violent video game". Since including pro-social content and adopting team play seem to foster pro-social attitudes, these two provisions are recommended to developers. A second aspect relevant to this perspective is identity, in terms of inclusion/exclusion of different identity groups as players, as professionals involved in the game industry and as characters represented in games. The stereotype of the player (and developer) as a young, white, heterosexual male does not seem to apply anymore to the gaming industry, but there still is a need for developing a more diverse and inclusive gaming culture among players. Possible ways ahead on this subject are community reporting mechanisms and commendation systems, as well as the inclusion of multifaceted player identities cutting across typical binary game community divisions. Attracting a wider audience is obviously an aim of the whole gaming industry, and achieving it would probably help to foster inclusion in gamers communities. To this end, some authors suggest avoiding overtly sexualised portrayal of women and increasing 'minority' representation in games ads and other representations of gaming that address the wider audience. Finally, the ethical implications of the monetisation of entertainment games is beginning to attract academic interest. In this regard, several authors have proposed frameworks for ethical game design that may lay the basis for making ethics an integral part of developer education and practice.

Last but not least, the seminal games overview provided in the section devoted to the practice-based sociocultural perspective addresses a number of milestone topics relevant to gaming culture. These are:

- the game characters, their cross-generational appeal and long lasting imprint, their sexuality and its representation in games, their identity and the conflict with sexism and racism;
- the different technological features, from very basic gameplay and simple narrative settings to 3D environments with player-controlled characters and/or augmented reality games;
- the issue of violence and conflict, the ever-controversial topic that continues to put games under media scrutiny;
- the competitive component of gaming, originally represented by the appeal of competition with friends and today made possible by multiplayer game structures;
- the new business models that have emerged following the revolution of downloadable content; these are based on different policies, including premium, freemium, microtransactions and dynamic advertising, and are linked to the tensions regarding the involvement of large audiences and/or long playtime;
- the co-existence of big brands of games and small studios, which are more willing to take artistic risks to satisfy their expressive needs and thus produce arts games;
- the recognition of games' affordances for education and their potential benefits, such as improving cognitive skills and heathy behaviour.

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2. Introduction

This document is the first scientific deliverable of Gaming Horizons (GH), a project funded by the European Union under the H2020 Initiative. GH is a Research and Innovation (RIA) Action of the ICT Call 2016-2017 that started in December 2016 and is due to conclude in January 2018.

GH explores the position and role of video games in society, aiming to encourage a more informed debate about how video games are developed, discussed in public and scholarly arenas, and used for cultural and educational purposes.

The project will mobilise Social Science and Humanities (SSH) expertise to critically analyse and challenge the H2020 research agenda on games and gamification, and in doing so propose alternative framings. It intends to document the growing interest in games with respect to equality and social justice, as well as the rise of innovative design approaches at the fringes of mainstream video game development, approaches that straddle traditional boundaries between entertainment, the arts and the humanities. Moreover, the project aims to suggest alternative criteria for defining the social and cultural value of games as 'learning tools' in both formal and informal environments. These criteria might include (but are not necessarily limited to) aesthetics, emotional connection, artistic integrity, and social responsibility.

Accordingly, GH pursues two main objectives:

- "Objective 1: to examine the current state of the art garnered from academic research evidence and informal debates at the intersection of digital games development, game studies / game criticism, and research on technology-enhanced learning, so as to suggest how mutually supportive connections between the ICT and SSH communities can help games and gamification move towards more mature and responsible integration in society.
- Objective 2: to draw on this, and on the connections established with project stakeholders, to open up the debate on issues such as equality, social justice and ethical game mechanics, analysing emerging development practices and cultures in a consultative fashion, and paving the way for shared criteria of responsible self-governance." (project Grant Agreement, p.7-8).

GH will address these two objectives through two main activity phases. The first involves a broad **landscape analysis** of contributions from all stakeholders (learners, educators, researchers, developers and policy makers) engaged - in various roles and capacities - in gaming research and practice, as well as in shaping, evaluating or delivering the official H2020 research agenda concerning games and gamification. The second phase of the project will be devoted to **cultural expansion** through engagement with stakeholder groups, aiming to broaden the cultural scope of the implications and affordances of games and gamification.

The first phase will be carried out in *Work Package 2 - Informed challenge through landscape analysis*, while the second will be carried out in *Work Package 3 - Cultural expansion through stakeholder engagement*. Work Package 1 is devoted to project management, scientific coordination and dissemination activities. As shown in Fig.1, WP2 activities mostly take place in the first half of the project timespan.

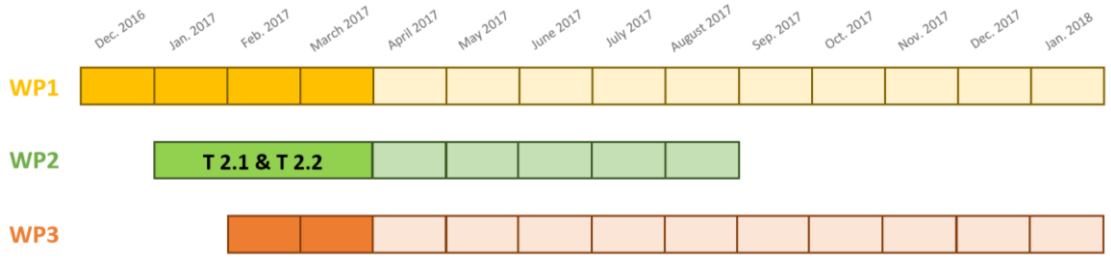

Figure 1. Timespan of the Gaming Horizons project

2.1. Purpose and structure of this deliverable

This deliverable reports results from the first steps in the GH landscape analysis, namely **Task 2.1** - Rapid, systematic review of evidence and **Task 2.2** - Definition of a methodological framework, as shown below in Fig.2. Outputs from both tasks lay the foundations for the pursuit of the project's overall objectives, with the Methodological Framework (MF), in particular, serving as a reference point that frames subsequent project activities.

The MF is a multidisciplinary and multidimensional framework providing a common structure for project outputs and a basis for defining the qualitative research methodologies of project tasks. This is reported in Section 3 of this deliverable; it

should be noted that this is not the final version of the MF as it will be further refined throughout the project in response to activities.

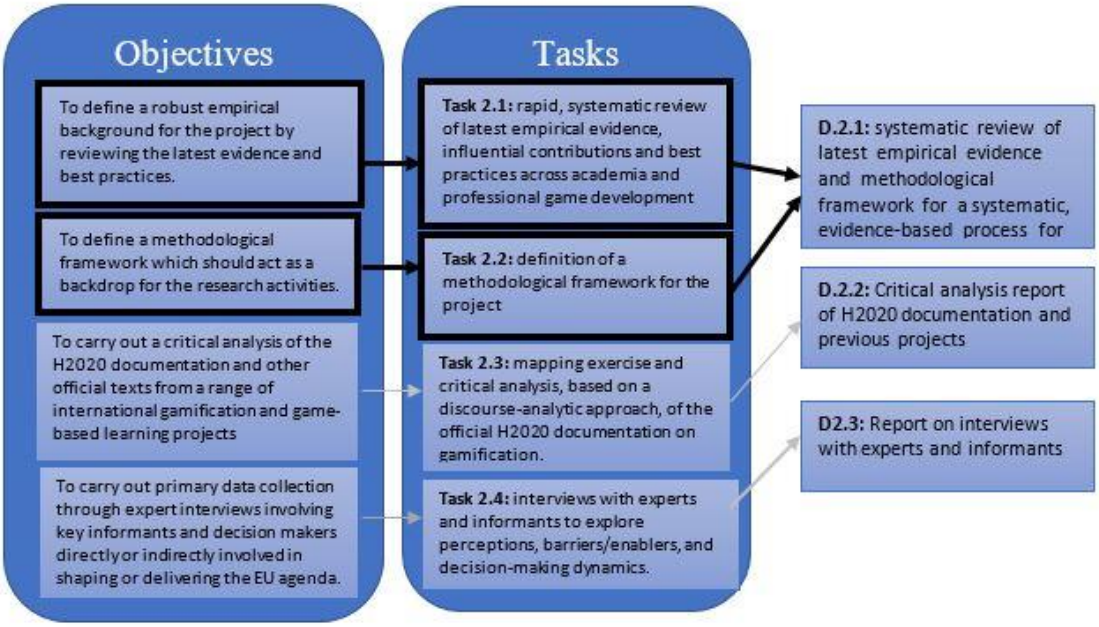

Figure 2. Overview of WP2 objectives, tasks and deliverables (black borders and arrows indicate elements relevant to this deliverable)

Section 4 reports the aims, methodology and results of the systematic review carried out in Task 2.1. This review focuses on the educational, psychological and ethical implications of digital gaming and gamification. As well as examining the academic literature, the review also includes a practice-based section based on expert developers' knowledge and considering contributions from the gaming community gleaned from informal sources such as blogs and websites. The review also presents recommendations drawn from the extant literature that are of interest to the different stakeholder groups that GH addresses.

Lastly, Section 5 discusses the main conclusions of the deliverable and draws on the future areas of work.

3. Gaming Horizons Methodological Framework

3.1. Gaming Horizons Conceptual Component

The methodological framework (MF) of GH embodies the multidimensional structure (termed here conceptual component of the MF) underlying all the tasks and activities of the project and informing the specific research methods used, and the research methods themselves (termed methods component). According to the Grant Agreement (GA), the MF constitutes a backbone and a guideline for the project and it is aimed to guarantee a systematic, evidence-based process for multidisciplinary engagement of all the relevant stakeholders (see GA– Part B – page 9).

As such, the MF can be defined as a unique and coherent core reference that scaffolds the methodological decisions taken, thus embracing and impacting on the research methods and techniques adopted.

Despite this definition, the framework should not be seen as something decided at the beginning of the project that simply guides and 'nurtures' the tasks outlined below; on the contrary: we expect the framework to be quite dynamic and to evolve over time, being fed back by the tasks themselves following their deployment. So, for example, while a preliminary version of the framework was already drafted in the project GA, this has already evolved as a consequence of the initial discussions among project partners, so what is presented in this document is the resulting updated version of that initial framework proposal. Similarly, we expect the MF to be fine-tuned during deployment of the subsequent research activities, and adaptations may be released in the future.

The direct outcome of the MF is a set of "recommendations" or "scenarios", according to the terminology used in the GA. In line with the idea of the evolving framework, these scenarios will be produced in the form of web-based outputs that can be updated as new inputs and insights emerge from the research process.

In the following, we describe the conceptual component of the MF first, followed by an overview of the methods component. In the provisional framework drafted in the GA, we mentioned it would be a bi-dimensional space, "whereby one dimension represents the type of games or gamified interventions, while the second

dimension represents the two main application contexts we propose to address: the design and development context, and the use context" (see GA – Part B – page 9).

Nonetheless, during the initial discussions launched at the kick-off meeting and then carried out in online interactions among the partners, it was agreed that a bi-dimensional space seemed too limited to capture the complexity of the area the project intends to cover.

Consequently, the framework was re-defined as a multidimensional space, providing a systematic view of stakeholders' engagement and disciplinary perspectives, completed with game types considered and data collection methods adopted, in such a way that all the relevant facets of the research field are adequately considered. In this section, we will describe in detail the dimensions of the conceptual component, as they have been defined and agreed by the consortium.

In particular, as far as the **stakeholders** are concerned, given the overall scope and main objectives of the project, the framework identifies the following profiles that need to be addressed:

- designer/developer;
- educator;
- researcher;
- user;
- policy maker.

It should be noted that originally the policy maker profile was not mentioned as a stakeholder in the GA (see GA– Part B – Table 1.3b); the consortium agreed this was an oversight and it has thus been included now. These stakeholders are intended as "receivers" of the recommendations that the project is to produce.

The same table in the GA listed the following disciplinary perspectives: pedagogical, psychological, cultural and ethical, artistic/aesthetic, neuro-scientific. After long discussion within the consortium, it was instead agreed to introduce two broader categories of perspectives: the academic perspective and the practice-based (or professional) perspective. For the purposes of this project, perspectives falling into the

"academic" category are those generally characterized by a formal discourse on the topic, usually practiced by scholars, and generating systematic outputs such as peer-reviewed research papers. On the other side, perspectives falling into the "practice-based (or professional)" category are those characterized by non-formal or informal approaches to discourse, usually practiced by professionals and/or practitioners, and producing non-systematic outputs such as websites, blog posts, newspaper articles, interviews, etc.

Some of the previously drafted perspectives were thereby merged:

- pedagogical aspects are now included in the "educational perspective";
- neuro-scientific issues have converged into the "psychological perspective";
- the "artistic/aesthetic perspective" – which the partnership acknowledged as being clearly different in nature from the others – is now redefined in a wider "practice-based" perspective and includes sociocultural, stylistic, artistic, and technological issues1 grounded in the informal professional culture of video game development. This is a more humanities-based perspective that considers the implications of game cultures as they are framed by practitioners, and as they manifest themselves in the public discourse, including social media, blogs and more traditional journalistic outlets.

The resulting list of **perspectives** is:

- academic discourse on the topic, which includes:
  - the Educational Perspective
  - the Psychological Perspective
  - the Ethical Perspective;
- practice-based discourse on the topic, which includes:

1 Given that one of the project partners (NHTV) has special expertise in these issues, the partnership decided to assign responsibility for this perspective to NHTV and treat it separately.

- the Sociocultural and Artistic Perspective.

As far as the **game categories** (and the sub-related types of games) are concerned, the GA was quite vague. For this reason, partners sought to identify an existing - and possibly consolidated - taxonomy that could be adopted in the project. Unfortunately, the partners failed to identify a suitable consolidated categorisation covering the entire breadth of the project's scope; although a plethora of game models, categories and definitions exist but only offer partial coverage. As a consequence, the following high-level categorization was adopted:

- Entertainment games;
- Applied games (including entertainment games used for learning and purposeful games, also called serious games);
- Gamification.

For a more detailed discussion of this categorization, refer to Section 4.2 - Games-related terminology.

We are aware that such level of abstraction could give the impression of being too superficial, and our initial position was to treat the categorisation as provisional and likely to be emended, in case it turned out to provide too vague inputs to the research process. In fact, while being used for the literature review reported later in this deliverable, its purpose as a heuristic, pragmatic strategy became apparent, therefore we decided to maintain it, at least for the time being. To be noted that this is another example of the framework being affected and tuned by the actual research tasks.

As mentioned above, the main outcomes of the framework are recommendations, which are of two types:

- General recommendations for multidisciplinary RRI (Responsible Research Innovation) applicable to all types of games, and
- Context-specific recommendations for different types of games or gamified interventions.

All in all, according to the GH framework, the three academic perspectives (ethical, educational, and psychological) are analysed from each stakeholder's point of

view for each game category. The same does not apply to the practice-based perspective (practice-based), which is instead analysed independently of stakeholder and game categories (see Fig.3).

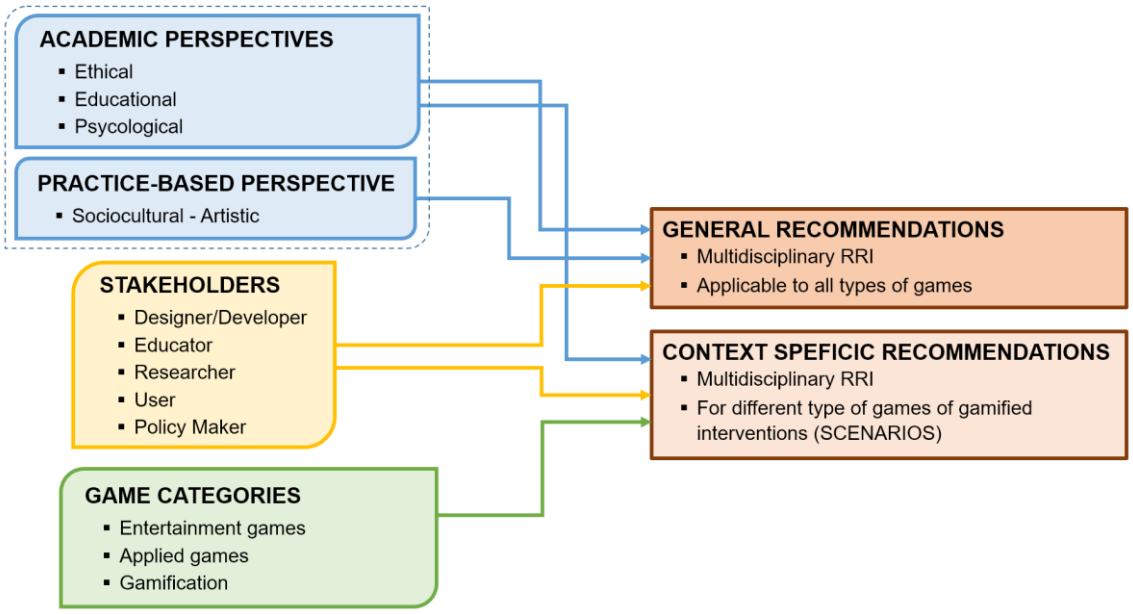

Figure 3. Conceptual component: the main dimensions involved

The relationships between these elements are presented in a more structured and schematic way in Fig.4 below. Here we can see that each cell containing the recommendations lies at the intersection between the disciplinary perspective and the stakeholder category.

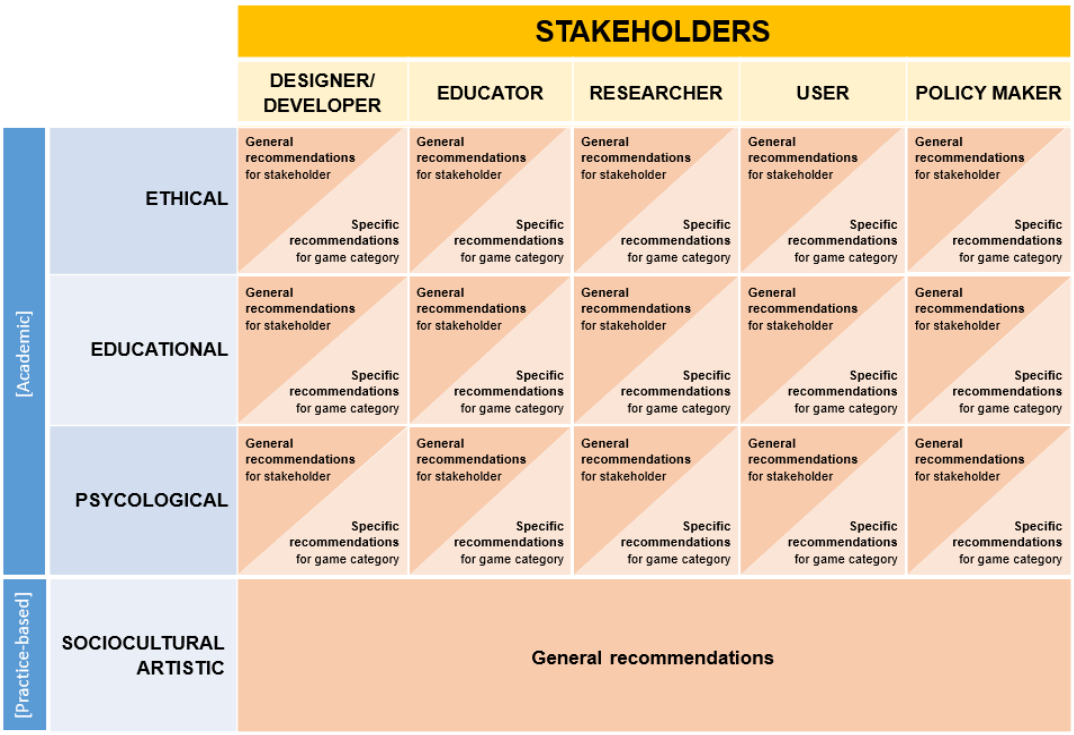

Figure 4. Conceptual component: interrelations between dimensions

It should be noted that we do not expect that each of the tasks in the Landscape Analysis (Work Package 2) will generate recommendations for each and every cell in Fig.4. For example, the analysis of the official H2020 documentation undertaken in Task 2.3 will mostly produce recommendations for policy makers. Similarly, the recommendations emerging from the literature review in Task 2.1 mostly address the educator, researcher, and developer categories. As a consequence, other tasks will address the remaining stakeholders, so to guarantee that they will not remain uncovered.

This is exactly the "typical use scenario" we anticipate for the methodological framework, i.e. to support us in ensuring that, overall, the project covers all the relevant areas.

3.2. Gaming Horizons Methods Component

The overall research design for the GH MF is descriptive and interpretive in nature, with particular focus on multidisciplinary inquiry that brings together the social sciences and the humanities (see GA– Part B – Page 10). Following from the project's objectives as stated in the GA and quoted in Section 2 of this document, on the one hand, and the

conceptual structure outlined in Section 3.1, the GH project comprises two distinct phases: 1) informed challenge through landscape analysis and 2) cultural expansion through stakeholder engagement (see GA– Part B – Page 9-17). Each phase, in turn, comprises several tasks. For example, phase 1 is articulated in:

- rapid, systematic literature review (Task 2.1),
- definition of a methodological framework (Task 2.2, whose output is this section of this deliverable);
- mapping and critical analysis of the Official H2020 documentation (Task 2.3),
- interviews with experts and informants (Task 2.4).

For each task, suitable data collection methods based on the conceptual structure will be defined, taking into consideration the types of data to be collected. For the purposes of this project, the data collection methods will be defined as sets of procedures, rules and principles for observing, gathering and analysing data in accordance with the conceptual structure. Fig.5 shows the triangle consisting of these three components, where interactions among them might take place in any direction, ensuring a process of continuous validation of the project methodology.

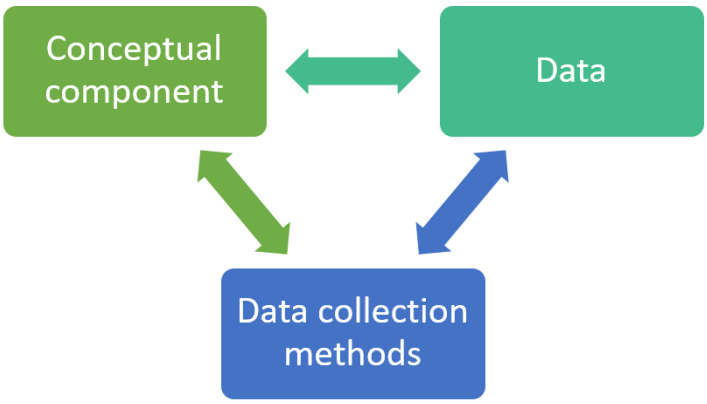

Figure 5. GH Methodological framework: data collection triangle

As already mentioned, each Task within the GH MF is characterized by a specific research method for data collection and analysis, as illustrated in the following sections, for the tasks mentioned above (except task 2.2). Research methods for the Tasks of phase 2 of the project will be defined later in the project.

Task 2.1: Rapid Systematic Literature Review - overview of the research method(s)

The rapid, systematic review of latest empirical evidence, influential contributions and best practices across academia and professional game development, is intended to build a robust empirical background for the project. The review comprises two parallel activities:

- one focusing on *documents* ascribable to academics or scholars (such as research articles, reviews, book chapters and so forth),
- another focusing both *on existing games and practice-based contributions from* professionals (in blog posts, websites, journalistic outlets, and so forth) concerning game development.

Both activities are conducted in accordance with the overarching MF described above and their results are described in Section 4 of this deliverable.

Task 2.3: Official H2020 Documentation Mapping & Critical Analysis - overview of the research method(s)

This task involves the thematic analysis of a corpus dataset of relevant textual sources representative of the official European discourse on gaming, gamification, game-based learning and related aspects. The analysis will focus on how themes and claims are framed within official documents, and it will highlight underlying biases and assumptions. The approach will also consider how gaming-related themes are informed by broader cultural repertoires about the role of technology to promote social change. The corpus will be divided in subsets, e.g. a) funding calls b) official project briefs and reports and c) mainstream media outputs including press releases and articles aimed at non-specialist audiences. The composition of the subsets may vary depending on their availability in the public domain. Each textual subset will be analysed independently. The corpus size will be determined by convenience sampling and theoretical considerations (i.e. theoretical sampling - see Glaser & Strauss, 1967), although we will ensure coverage. For instance, we will select all funding calls where gaming was a primary or secondary aspect, starting from those under the “Information Society Technologies” of the Sixth Framework Programme. Official repositories such as the Community Research and Development Information Centre (CORDIS) will be queried, in addition to targeted web-searches.

The interpretative framework will be developed in a cyclical way, but the foundations will be laid through the following guiding questions: How is gaming being represented and actively constructed as an ICT innovation? How are priorities and funding criteria articulated and justified in the text? How is a shared consensus on "game-based" ICT in various application areas (e.g. formal education, corporate training, health etc.) being encouraged and realised linguistically?

Once constituted, the dataset will be analysed using established methods of discourse analysis (Wodak & Meyer, 2009), and adopting a mainly interpretative approach rather than focusing on syntactic and grammatical aspects. Quantitative techniques of corpus analysis will be used – such as concordance analysis – to examine recurring patterns in the structure of sentences and clauses that point to underlying themes and "biases".

Task 2.4: Interviews With Experts And Informants- overview of the research method(s)

As noted in the GA (see GA – Part B – page 11), "Responsible Research and Innovation relies on a systematic approach to public engagement, whereby stakeholders (researchers, policy makers, citizens, business and other groups representing different aspects of civil society) work together to better align an innovation process with societal values and expectations (von Schomberg, 2011). The overarching model is that of participatory agenda, setting through the mechanisms of reflection and inclusive deliberation."

Following this broad methodological indication, the project engages stakeholders in systematic and explicit thinking around the societal role of gaming to: 1) reflect critically on the current state of the art; 2) to "open up and explore promissory narratives of expectation" (Owen, Macnaghten, & Stilgoe, 2012).

In particular, as already mentioned, interviews with experts and informants are envisaged in Task 2.4 to explore perceptions, enablers/barriers and decision-making dynamics that underpin the gamification and applied games landscape. Interviews have been identified by the project as the main interaction technique, because the focus is on the often implicit nature of expert knowledge, taking into account biases and

institutional forms of consensus, which would be difficult to detect through more direct approaches, such as example questionnaires.

Furthermore, in order to stress the participatory approach that the project is endeavouring to embrace, we are now considering the inclusion of group interviews, even though the former were not originally foreseen in the GA (see GA - Part B – page 14). This aspect is still under discussion, but more collective techniques (such as the Delphi Study, the Nominal Group Technique or the Focus group) are possible options.

In any case, the textual data collected will undergo discourse analysis to detect thematic patterns that point to implicit biases and underlying assumptions.

4. Literature review

4.1. Introduction

This section of the deliverable describes the methodology adopted and the outcomes obtained from the literature review. In line with the project GA and the methodological framework (Section 3 of this document), the objective of this study is twofold:

- to lay the basis for future work in the project by delineating the landscape of research on games and gamification based on extant academic literature (notably for the Educational, Psychological and Ethical disciplinary perspectives), with particular emphasis on the recommendations that can be drawn from the analysed literature;
- to complete the above landscape with a practice-based section, focusing on the sociocultural and artistic perspective.

The method adopted for the three academic perspectives is in line with the consolidated approach to systematic literature reviews described by Petticrew & Roberts (2006), although some adaptations were made in order to cope with the extremely extensive body of literature obtained due to the wide scope of our content domain. Regarding the fourth perspective, the practice-based sociocultural and artistic perspective, the methodology adopted is less formalised and reflects the need for harvesting information from sources other than academic research.

This literature review, therefore, is structured as follows:

- this introduction;
- a section devoted to clarify the terminology adopted throughout the document;
- a description of the methodology adopted for the three academic perspectives, focusing on common aspects across perspectives and comprising a rationale for the choices made;
- a section reporting the quantitative data that emerged from the systematic analysis of the core studies reviewed;

- one section for each of the three academic perspectives (educational, psychological and ethical), each comprising a description of bespoke methodological aspects, a section on relevant state of the art and one concerning emerging recommendations for stakeholders;
- a section concerning the practice based, sociocultural and artistic perspective, characterized by a more interpretative approach, in order to identify the cultural and artistic impacts of gaming as a medium.

The conclusions of the literature review are reported in the conclusive section of the deliverable, together with a summary of take away messages from this work.

4.2. Game related terminology

One of the main problems faced while carrying out this literature review is the diversity in the terminology adopted in the various papers that we have considered. To testify the existence of this diversity in – sometimes contradictory - meanings, we have collected a number of definitions of terms frequently used in the field and their sources; this is included in the Appendices (Section 7.1). This inconsistent terminology can be seen either as a sign of scarce maturity of the field or merely as an effect of the high speed of evolution in the subject area, paralleling evolution in the underlying technology. More likely, it is the effect of both. Indeed, the taxonomy underpinning research into games and gaming is extremely complex and highly contentious, in part because it is fraught with conflation and what Landers (2014) calls “construct proliferation” (p.754). Attempts have been made to define as well as challenge existing taxonomies of game-related terms (Apperley, 2006; Ratan & Ritterfeld, 2009; Teixeira, Sá, & Fernandes, 2008), but none seems to have succeeded in being generally accepted. Making order out of the chaos of gaming terminology is not an ambition of this deliverable, but before we go deeper into the description of the method used in the literature review and of the review results, we need to clarify the scope of its content and the meaning we attribute to some of the terms used. To do so, we have adopted a pragmatic, grounded approach by drawing on the definitions of key game- and gaming-related concepts that appear in the set of publications gathered for the review (these are listed in the Appendices, Section 7.1).

Firstly, we embrace Wouters, van Nimwegen, van Oostendorp, & van der Spek (2013) definition of computer games which is, in turn, based on previous literature. According to Wouters et al. (2013), computer games are interactive environments (Prensky, 2001; Vogel et al., 2006) that are based on a set of agreed rules and constraints (Garris, Ahlers, & Driskell, 2002) and that challenge the player(s) towards a clear goal (Malone, 1981). In addition, computer games constantly provide feedback, either as a score or as changes in the game world, to enable players to monitor their progress toward the goal (Prensky, 2001). In this deliverable, we use the terms video games, computer games and digital games to refer to one general class of games. This class includes games where play does not necessarily take place entirely in a digital environment; it may partly occur in a hybrid space, through interaction with tangible objects in the real world. Digital games are thus regarded as such provided they have a digital component. All types of digital, computer or video games are relevant to our literature review, while non-digital games, i.e. those without any digital component (e.g. physical games, board games, etc.) are disregarded. Among the broad category of videogames, we distinguish between three main categories:

- **entertainment games**, that is games that have been developed and are used mainly for entertainment purposes;
- **applied games**, i.e. games designed or used with a primary purpose other than supporting play and/or entertainment. This purpose may be learning, or any other purpose such as healthcare, defence, advertising, culture or art. Some authors regard the term applied games as a synonym of serious games (Ratan & Ritterfeld, 2009). In our interpretation, **serious games** are *designed* for a purpose other than entertainment (we also refer to these as **purposeful games)**. In this deliverable, the term **applied games** refers to an overarching category that covers both serious/purposeful games but also entertainment games or COTS (Commercial off the Shelf Games) where these are used for a serious purpose, namely a purpose other than entertainment. Typically, this regards **entertainment games for learning**.
- **gamification,** that is the use of game design elements in non-game context(s) in order to influence user behaviour. While this definition of

gamification is perhaps one of the most generally agreed upon in the landscape of literature relevant to this deliverable (Deterding, Dixon, Khaled, & Nacke, 2011; Landers, 2014; Versteeg, 2013), the definition itself contains a contentious term. The meaning of the expression "game element" is far from being well established. In the context of this deliverable, we will adhere to Hunicke, LeBlanc, & Zubek's (2004) definition of game elements as **game mechanics** (i.e. the way games convert players' input into specific outputs), **game dynamics** (i.e. the way games guide interactions between players and game mechanics) and **game aesthetics** (the way game mechanics and dynamics interact with the game designers' artistry, to produce cultural and emotional outcomes (Hunicke et al., 2004).

So, if the difference between the first two categories (entertainment games and applied games) mainly regards the usage purpose, the difference between games in general and gamification is much deeper, in that the relationship between gamification and games lies "only" in the fact that a gamified experience or environment borrows elements from games, but is not a fully fledged game.

4.3. Methodology for the analysis of the academic perspectives

This section describes the various steps followed to identify the core set of academic literature that provided the basis for our work. We used the same approach for the three different academic perspectives, and this stepwise approach is described in the following. However, based on the results of this work, each perspective then required bespoke adjustments. This section thus describes the common part of the work, while the methodological adaptations carried out for each perspective are described in the respective sections (see the Methodological Specificities subsections 4.5.1, 4.6.1 and 4.7.1)

4.3.1. Step 1 - Keywords identification

Our work started with an effort to identify the main constructs that, according to the project proposal, should be dealt with in the literature review. We based this effort on brainstorming with project partners (during the kick off meeting and subsequent virtual meeting), on reading/scanning extant literature on gaming, especially recent papers from

specialised journals and conference proceedings, and making ad-hoc queries on various databases, with the aim of identifying the main keywords that should be used in our systematic review. At this point, we also decided that the next step would be based on queries on Scopus and WoS. Given the very broad scope of the review, limiting the query to these two very comprehensive sources would strike a balance between the need for maximising Social Science and Humanities coverage and that for minimizing the number of off-topic results, such as those with a strong emphasis on technological aspects.

This step led us to the phase of systematic search with clearer ideas about what to look for in our queries and where. In particular, most of the keywords used for the search (reported in Table 1) were identified in this step.

4.3.2. Step 2 - Database queries

A total of six queries were then devised (through an iterative process of trial and error) and performed - at the end of February 2017 - in order to construct the first, unfiltered corpora: one for each perspective (Psychological, Pedagogical, Ethical) on each of the two chosen databases: Scopus and Web of Science (WoS). The process for building the queries was guided by two complementary aims: to include as many relevant documents as possible, and to limit the results only to those explicitly focused on the impact of gaming (excluding, e.g., studies in which games were only a control condition or were not the main focus of the study). In order to fulfil these aims, criteria for inclusion of each item included the requirement that search keywords should be present not only in the retrieved item's title or abstract, but also in the author keywords (using the logical operator AND) - on the assumption that author keywords are indicative of the main focus of a study. However, implementation of this decision required separate procedures for the two databases: while Scopus can limit a search to each of the above sub-fields (title, abstract and author keywords), Web of Science (WoS) does not offer an equivalent functionality, because searches by topic in WoS actually search within title, abstract, or keywords[2] (with a logical operator OR). As a consequence, WoS results were post-

2 It should be noted that keywords in WoS include both author keywords and additional keywords provided by Thomson Reuters while populating their databases.

processed in R[3] to select those that contained our search keywords both in the title/abstract *and* in the author-keywords. The R code used to this purpose is available in the shared space of the project[4].

The full list of criteria used for constructing the queries is as follows:

1. Retrieved documents are required to have at least one gaming-related word both in title/abstract and author keywords (not necessarily the same word in all fields);
2. Retrieved documents are required to have a perspective-related word both in the title/abstract and author keywords (not necessarily the same word in all fields);
3. Retrieved documents should NOT have keywords belonging to the "excluded keywords" category in either abstract/title or author keywords;
4. Retrieved documents have to be published from 2010 (included) to 2017 (excluded, because separate queries were conducted for contributions published in 2017);
5. Retrieved documents should be classified as articles, reviews, books, or (Scopus-only) articles in press;
6. Retrieved documents should be in English;
7. (WoS-only) Contributions should be indexed in SCI-EXPANDED, SSCI, A&HCI, BKCI-S, and/or BKCI-SSH.

Table 1 below shows the sets of gaming-related keywords, perspective-related keywords, and exclusion keywords.

3 R is an Open Source programming language and environment for statistical computing and graphics Website at https://www.r-project.org/about.html

4 https://goo.gl/OOdozg

Table 1. Query terms used for the literature search

Gaming-related keywords	game*, gaming, videogam*, gamif*, mmorpg*, rpg*
Psychology perspective keywords	psycholog*, neuropsych*, cogniti*, behavi*, memory, "problem solving", "decision making", creativity, "critical thinking", addict*, depression, anxiety, stress, engagement, motivation, flow, immersion, enjoyment, emotion, emotive, affective, autonomy, "self-regulation", attention, concentration, cooperation, collaboration, competition, arousal, empath*, reward*
Educational perspective keywords	learn*, teach*, pedagog*, educat*, school*, universit*, instruction*, pupil*, student*, grades, class, classroom
Ethical perspective keywords	ethic*, moral*, aggressi*, discriminat*, prejudic*, toleran*, diversity, exis*, "social justice", equity, equality, racis*, racial, inclusion, exclusion, disabled, disabilit*, exploita*, violen*, bully*, bullism, privacy, immigra*, "social integration", "multicultur*", gender
Excluded keywords	game theor*", olympic, commonwealth, gamet*, "ultimatum game", "dictator game", "dilemma game", "economic game", "evolutionary game", "public goods game"

Queries from each perspective only differ in the keywords used for criterion (2). Criterion (3) was devised to exclude irrelevant results, especially studies on sports (e.g. Olympic Games), contributions from game theory or econometrics (in which 'game' has a different meaning than in our focus), or biology studies (search word game* would have included "gamete"). Criterion (4) was meant to limit our queries to the most recent contributions, as games are rapidly evolving and dated results may not be relevant anymore. Criterion (5) purposefully excluded conference proceedings from the query results. Conference papers and posters may represent the most cutting-edge research available at any given time, and including them may have allowed us to capture more recent research trends. However, time constraints required the present review to be limited only to pieces of work representing robust and consolidated research as well as established research trends in each perspective. This aim was further pursued in item selection following the initial queries. For similar reasons, criterion (7) excluded the recently introduced section Emerging Sources Citation Index (ESCI) of the WoS.

Scopus and WoS queries for each perspective are reported in Appendices 7.2. These queries retrieved:

- 3881 contributions (Scopus, Psychology), + 76 published in 2017;
- 2520 contributions (Scopus, Education), +47 published in 2017;
- 519 contributions (Scopus, Ethics) + 9 published in 2017;
- 17492 contributions (WoS, Psychology), + 110 published in 2017. Reduced to 1790+26 after keyword-based filtering. Of these, 790+19 were retrieved from both the Scopus and the WoS query;
- 9123 contributions (WoS, Education), + 52 published in 2017. Reduced to 1288+5 after keyword-based filtering. Of these, 460+2 were retrieved from both the Scopus and the WoS query;
- 5633 contributions (WoS, Ethics), + 31 published in 2017. Reduced to 415+3 after keyword-based filtering. Of these, 148+3 were retrieved from both the Scopus and the WoS query.

The original, unfiltered query results across perspective, database and year are shown in Fig.6.

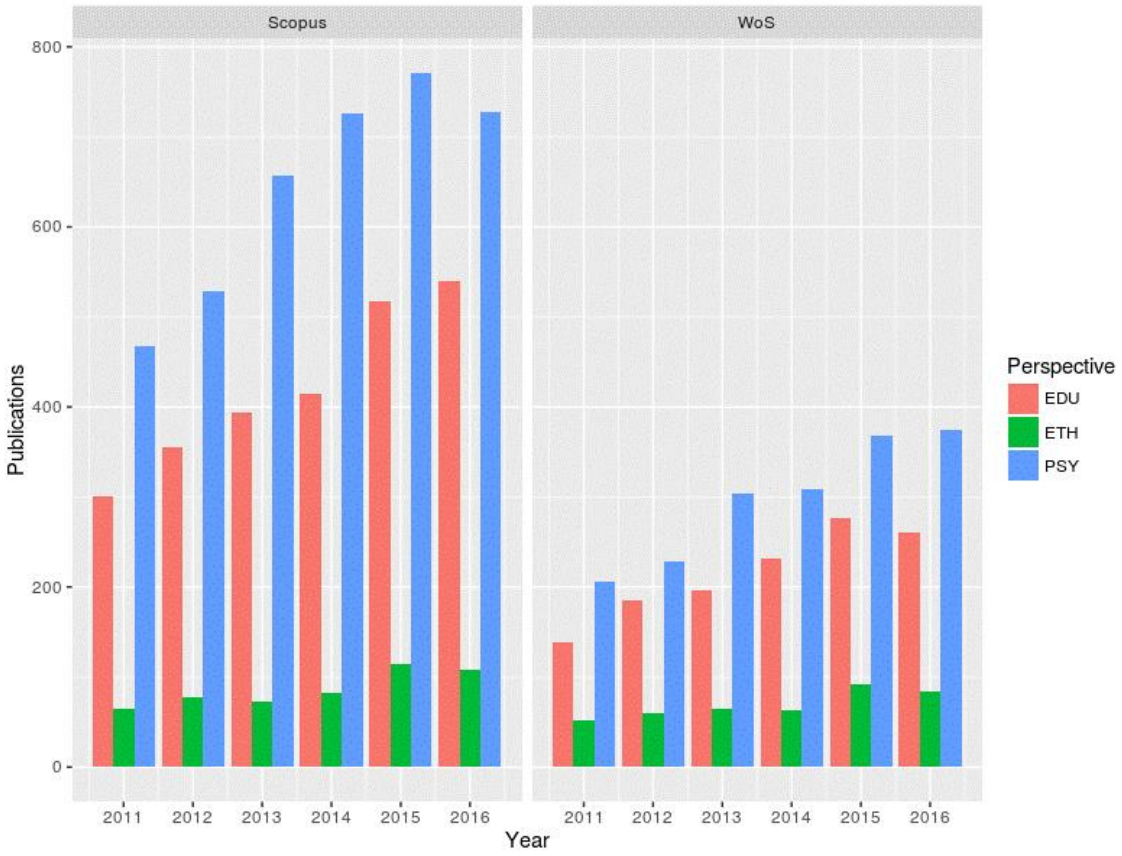

Figure 6. Number of items retrieved by perspective, database and year (including duplicates)

4.3.3. Step 3 - Automatic filtering of results

The number of contributions retrieved using the six queries proved to be too high for manual selection of the relevant ones, even on the basis of abstracts alone. Even considering only reviews and meta-analyses, and disregarding the fact that Scopus and WoS's classification of reviews is not completely accurate, the number of contributions (300) was prohibitively large to analyse in the timespan available for this task (3 months). For this reason, in order to identify the contributions most likely to be influential, a citation-based filter was applied. For each year, only publications with a number of citation one standard deviation above that year's average citation number[5] were retained. Applying the criterion separately for each year avoided penalizing the most recent items. Therefore, the resulting datasets only included relatively highly cited contributions:

5 As computed from the retrieved dataset of contributions.

- 299 and 142 for the psychological perspective (Scopus and WoS, respectively);
- 171 and 92 for the educational perspective (Scopus and WoS, respectively);
- 63 and 48 for the ethical perspective (Scopus and WoS, respectively).

Subsequently, duplicate items due to the presence of items in both databases were removed, keeping only the WoS record. However, some documents were retrieved for multiple perspectives, and were therefore present in the datasets of more than one perspective. These duplicate items were also removed in a systematic fashion, keeping only the record in the smallest dataset (for example, if a contribution was selected for both the Psy-Scopus and the Eth-Scopus dataset, it would be retained only in the Eth-Scopus dataset). This strategy was arbitrary and simply meant to ease subdivision of labour in the subsequent steps. Before removing the duplicate records, information on which queries identified each contribution was recorded and embedded in the dataset. After duplication removal, the total number of retained contributions was 554, distributed as follows:

- 166 and 103 for the psychological perspective (Scopus, WoS);
- 112 and 90 for the educational perspective (Scopus, WoS);
- 35 and 48 for the ethical perspective (Scopus, WoS).

Contributions published in 2017, retrieved using separate queries, were not subject to citation-based filtering. As the search was conducted at the end of February, 2017, a citation-based selection would have been meaningless; all these contributions (120 after duplicate removal) were retained for manual selection.

4.3.4. Step 4 - Manual selection of contributions

The 674 documents retained after automatic filtering went through a further step of manual screening based on the reading of their titles, abstract and keywords. Contributions that were clearly outside the scope of the project (i.e. some contributions on game theory that were not excluded by the query) were directly removed. Contributions that *were* related to the impact of gaming, but not from the point of view of the considered perspectives, such as studies focused on physical health, were retained

only if they were reviews/meta-analyses. Contributions in which gaming represented only part of a wider phenomenon (e.g. technology, new media, addictions) were retained only if they were reviews/meta-analyses. Studies conducted on animals, with no direct human application, were excluded. Studies focused strictly on computer science (e.g. programming, algorithm devising) were excluded.

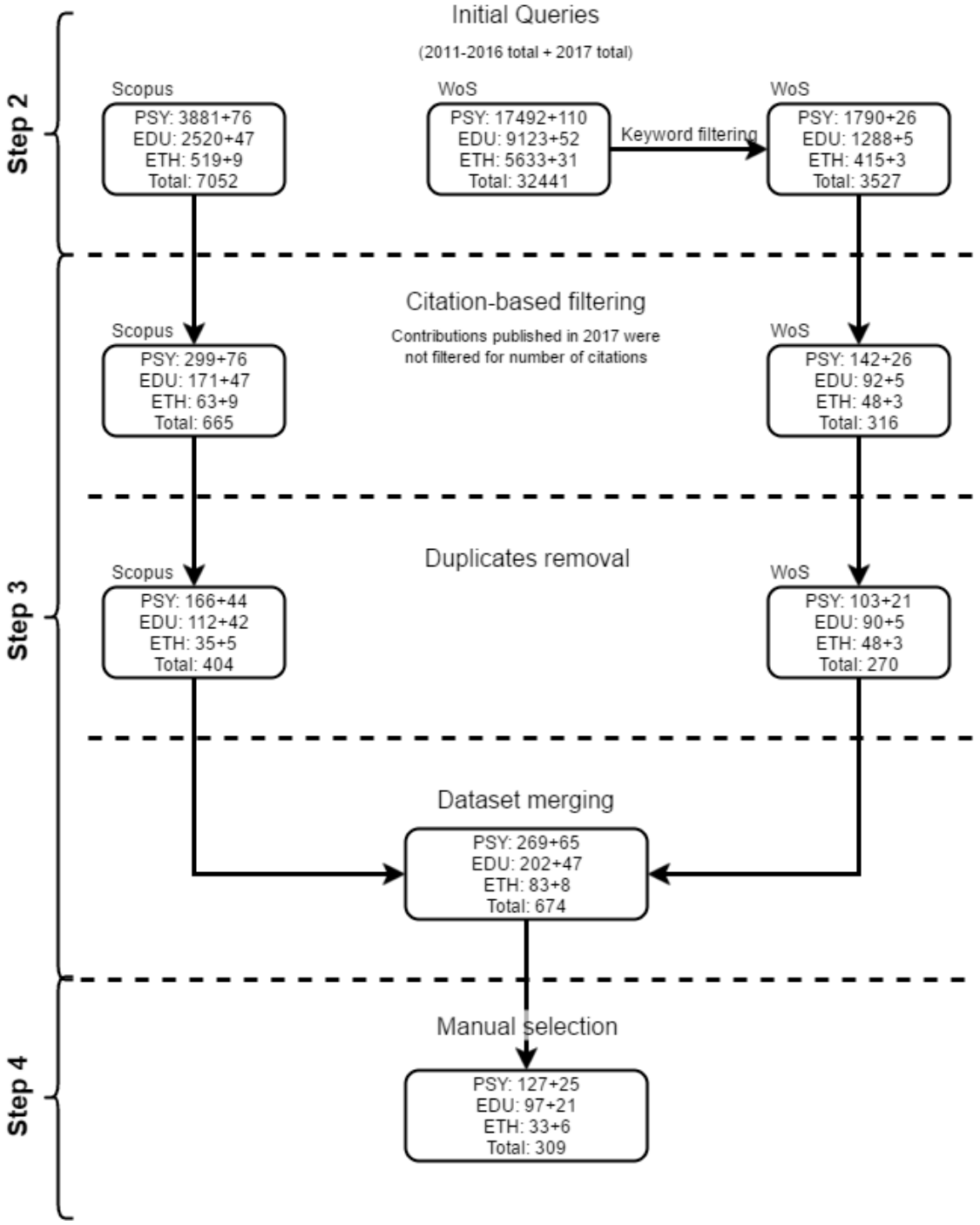

Figure 7. Steps 2 to 4 of the methodological approach to the literature review

Based on the above criteria, a training session with six coders was carried out to ensure consistent interpretation of the criteria themselves. The six coders then proceeded independently to select manually the items of the datasets. After manual selection, the final datasets included 152 contributions for the psychological perspective, 118 for the educational perspective, and 39 for the ethical perspective, for a total of 309 items. Steps 2 to 4 and their results are illustrated in Fig.7.

4.3.5. Step 5 - Analysis of documents

The 309 items that emerged from Step 4 were still too many to code manually in the short time available. It was therefore decided to identify a core set of literature reviews and meta-analyses for coding and thorough analysis, and possibly integrate the set with further references where deemed necessary. Thus, the 309 items were evaluated in terms of their suitability for coding, according to the decision of dedicating the coding effort to literature reviews and meta-analyses. This evaluation was carried out based on the metadata of the source databases (Scopus and WoS), with a subsequent manual check due to the fact that these metadata aren't always accurate. The final filtered dataset thus comprised 47 documents: 18 for the educational perspective, 26 for the psychological perspective and 3 for the ethics perspective. These were thoroughly read, analysed and coded according to the coding schema reported below in Table 2.

Other papers that added significantly to the insight gained from the coded literature reviews or meta-analyses were also included in the in-depth analysis. In this regard, particular priority was given to studies on topics that were considered to be under-represented in the current review, as determined by analysing the associational network of keywords for each perspective (these are included in the sections dedicated to each perspective). This was particularly relevant for the ethics perspective, given that only 3 reviews emerged from the filtering process. Accordingly, three more reviews – as well as other papers – were retrieved from the unfiltered search results and analysed so to ensure adequate thematic coverage of the perspective.

Table 2 below reports the fields used to code the documents involved. The complete schema and the criteria adopted for coding the documents considered in the literature review is provided in the Appendices Section 7.3.

Table 2. Codification structure adopted for the coding process

Field	**Subfields**	**Possible values**
Reference metadata	Authors, title, source, year, type of publication, keywords, abstract	As in paper
Database	*WoS or Scopus or Other source*	y/n
Coder		Coder's initials
Relevance	*Relevance rating*	0/1/2
Disciplinary perspective	*EDU or PSY or ETH*	More than one perspective per document possible
Topic		Open field (cannot be empty)
Type of games	*Game category*	entertainment game or purposeful game or gamification
	Game type	Open field, author terminology
Research methodology	*method*	Qualitative/quantitative/ mixed /theoretical/review
	scope	0/1/2
	Methodological soundness	0/1/2
	Comments on generalisability	Open field
Recommendations	*Explicit Recommendations*	As expressed by authors
	Implicit recommendations	Expressed by coder
	Stakeholder relevance	Developers and/or educators and/or users and/or policy makers and/or researchers
Classification problems		List of names of fields or subfields involved in the problem

4.3.6. Keyword networks

As mentioned above, time constraints prevented us from manually screening the 10579 records retrieved from the initial six queries. However, since we are aware that citation-based filtering of contributions may be biased and unfairly exclude pioneering research and contributions from some research groups, we conducted an analysis of the author keywords of the unfiltered datasets to obtain a complete picture of the literature pertaining to our three perspectives. For each perspective, the Scopus and WoS datasets were merged, removing duplicates, and an associational map of author keywords was

constructed using VosViewer 1.6.5 (van Eck & Waltman, 2014)[6]. The keyword maps show which author keywords co-occur in the dataset's records. The nodes of the map correspond to the authors' keywords of our documents, provided that their number of occurrence is above a user defined threshold[7], while node size is proportional to keyword frequency. Keywords that co-occur in many records are more strongly associated, and this association is adjusted by each keyword's frequency and by the amount of keywords in each record. The layout of the networks is based on associational strength: closely associated groups of keywords will tend to be clustered together, while less associated keywords will be towards the periphery of the network. The three networks corresponding to the three perspectives have been analysed qualitatively, by comparing their structure to the content of the contributions read and analysed in order to identify under- and over-explored parts of the network.

Additionally, we computed correlations between keyword frequencies in the unfiltered and citation-filtered databases for each perspective, in order to ensure that the most frequent keywords in the originally retrieved set of contributions would continue to be highly represented after automatic filtering. Correlations were .80, .82, and .85 for the psychological, educational and ethical perspectives, respectively. This result suggests that, at least in terms of topics, the distortion introduced by citation-based filtering of contributions is limited.

The purpose of constructing keyword networks on the unfiltered database is twofold: on the one hand, it complements the data from correlation of keyword frequency reported above, thus ensuring that citation-based filtering did not excise important research areas from the corpora; on the other hand, neatly clustered networks directly provide a bird's eye view of each perspective, informing on the potential

6 Keywords were pre-processed, removing spaces, punctuation, and plurals so as to merge alternative spellings of the same keywords (e.g. game-based learning, game based learning, games based learning)

7 The thresholds we chose for the three perspectives were determined according to the criterion of striking a balance between maximum coverage and readability of the map.

separation of its research lines and naturally suggesting a structure for the discussion of the literature analysis for each perspective[8].

While the former functions were achieved for all three perspectives, as we will see in the following sections, the latter function was only successfully achieved for the psychology and ethics perspectives. The networks will be discussed separately in each perspective section (4.5, 4.6 and 4.7).

4.4. Quantitative data from coding

The literature search and filtering procedure described above yielded a total of 47 systematic literature reviews and meta-analyses, which are listed in the Appendices Section 7.3. These were coded using the coding schema shown in Table 2 (section 4.3.5); detailed version in the Appendices Section 7.3. This section reports the results of quantitative analysis of the aggregated coding data, while the subsequent sections (4.5 to 4.7) provide more in-depth results about each of the perspectives analysed.

Perspective distribution

The distribution of the core studies analysed is shown in Fig.8. The preponderance of psychological studies is evident (N=26), while ethical studies (N=3) are definitely very few in number. To compensate for this, more literature on ethics was sought following the approach described in Section 4.7. In any case, these proportions roughly respect those of the original data, shown in Fig.6.

8 This has been possible for the psychological and, to a lesser extent, the ethical perspective. The educational perspective network was less neatly clustered and did not present a readable overview of the research (see below)

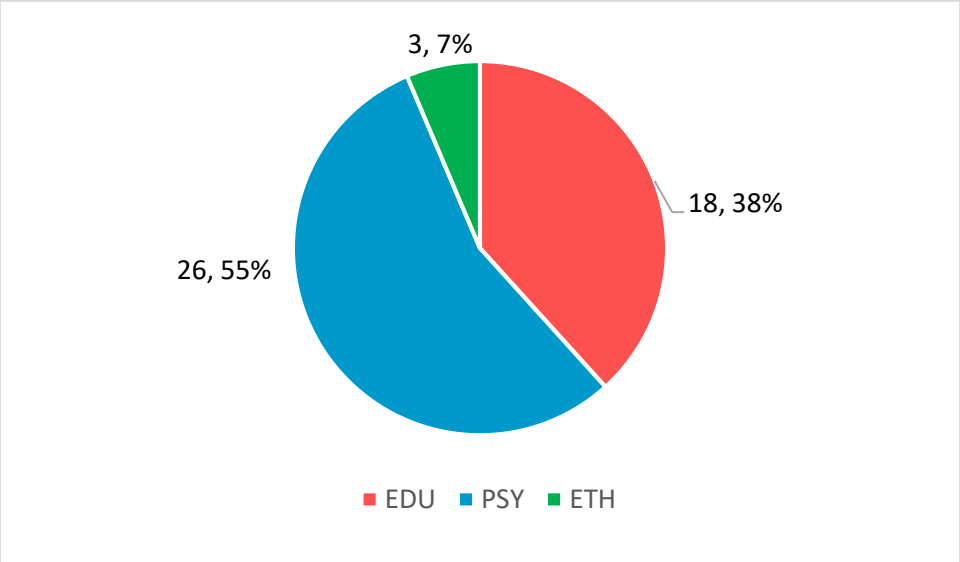

Figure 8. Distribution of the core literature among the three academic perspectives

Gaming category

The coding process allowed us to position the studies analysed across the three broad categories of entertainment games, applied games (comprising entertainment games used for learning and purposeful or serious games), and gamification, according to the terminology defined in Section 4.2. As Fig. 9 reveals, the great majority of the studies pertain to the first two categories; it should be noted that some of the core reviews and meta-analyses were broad in scope and encompassed multiple categories, thus falling in the "not applicable" case. Fig.9 also presents the split between the two sub-categories of applied games, showing that studies on applied games mostly regard purposeful games, rather than the use of entertainment games for learning.

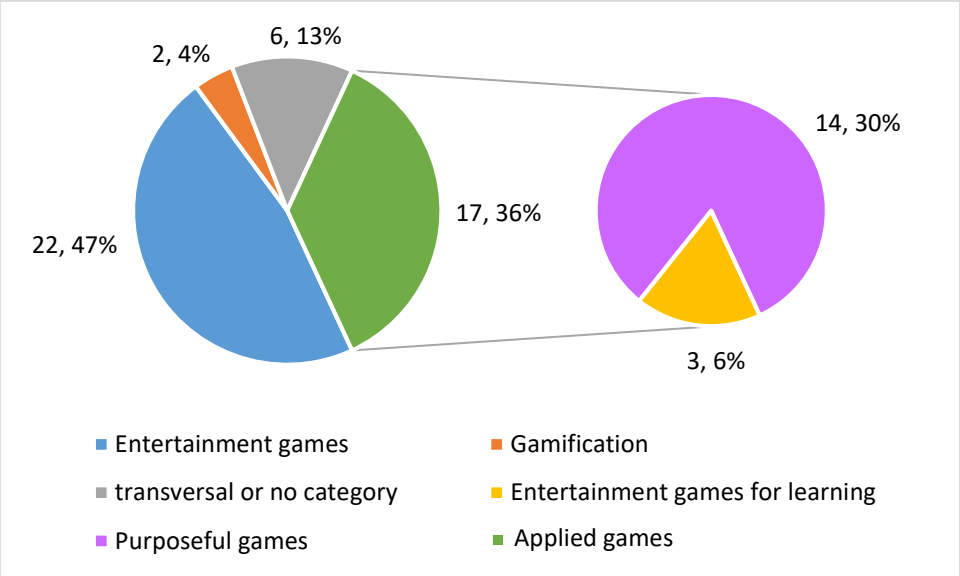

Figure 9. Distribution of the core studies across the game categories

Author-defined game type

As mentioned in section 4.2, different game-related terms are used by authors of the academic literature to identify specific types of games. As there is no general agreement about the meaning of the terms, we coded the "game type" field with the prevalent terms each author used. The following distribution of game types was obtained (number of studies using each term is in parenthesis):

- Entertainment games [total = 25]: videogames (11), online games (5), accessible videogames (1), digital games (1), internet games (1), action video games (1), commercial games (1), multiplayer sandbox building game (1)
- Purposeful games [total = 14]: serious games (6), exergames (4), game based learning (2), digital games based learning (1), virtual reality technology based instruction (1)
- Gamification [total = 2]: Gamification (2)
- Not applicable = 6

Scope of review / analysis

Some of the reviews analysed were very broad in scope (N=32), others more restricted (N=11) and a few others were classified as having negligible scope. This last value was

assigned when the review only concerned one specific aspect of study or a single game (N=2). In 2 cases the researchers did not assign any value to this item.

Methodological soundness

Similarly, the researchers classified the analysed studies according to the level of methodological soundness/ robustness. To this end, they considered the way authors treated available evidence in drawing their conclusions and the possible presence of methodological flaws. Soundness turned out to be high for the majority of papers (N=24), average for many (N=16) and low for only a minority (N=7).

Author recommendations

In 42 of the 47 coded reviews / analyses, the author/s expressed at least one explicit recommendation addressed to stakeholders. In 42 cases reported findings could be interpreted as implicit recommendations (3 records yielded no recommendations of either type, while 4 yielded only one type).

Stakeholder category addressed in recommendations

Where one or more author recommendations were recorded (explicit or implicit), this value was associated with a stakeholder category (or categories) expressing the perceived target of the recommendation/s. So each paper was coded as containing "recommendation items" for one or more GH stakeholders, or none. A total of 81 "recommendation items" were associated to the GH stakeholders, and Fig.10 shows their distribution across stakeholders.

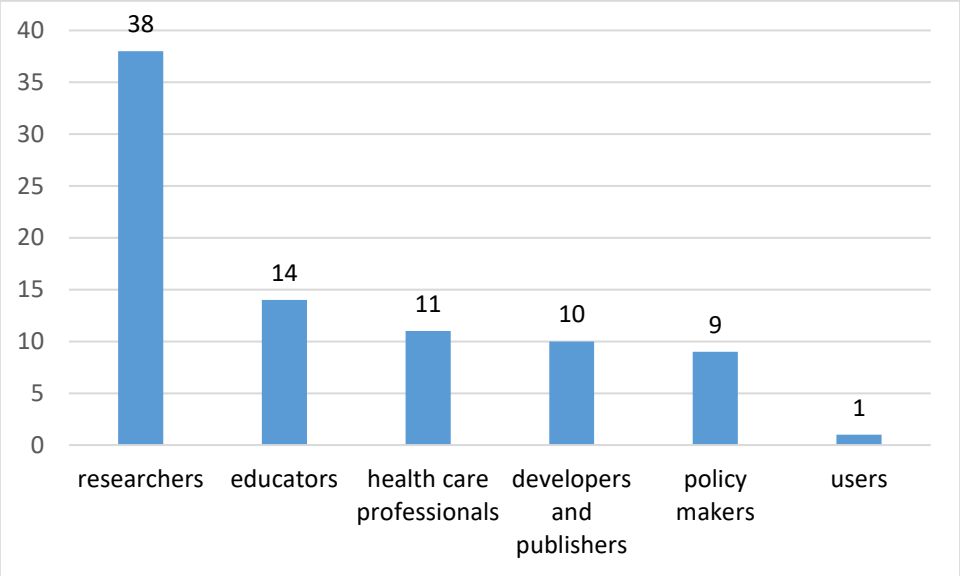

Figure 10. Number of studies addressing each stakeholder

4.5. *Educational Perspective*

4.5.1. Methodological Specificities

This section of the deliverable focuses on the educational perspective on gaming. The core set of papers analysed comprises the 18 literature reviews selected according to the criteria formerly described in Section 4.3 - Methodology for the analysis of the academic perspectives. The scope was subsequently widened to include other papers present in our dataset, as well as key papers cited by those included in the review and others retrieved from supplementary targeted queries through Google Scholar.

As also mentioned in Section 4.3 Methodology for the analysis of the academic perspectives, the map of author-defined keywords from the original dataset generated for this perspective is very complex and intricate, with node clusters comprising very heterogeneous keywords related to different types of games, disciplines and learning approaches. This heterogeneity possibly reflects an equally messy landscape on research in this area. As opposed to what happened with the other two perspectives, it was therefore impossible to derive from the keyword map a structure for framing our analysis of the educational applications of gaming (see Fig.11). We therefore derived a suitable structure for this section in a grounded fashion by drawing on the reviews considered in this perspective so as to cover the scope of the content.

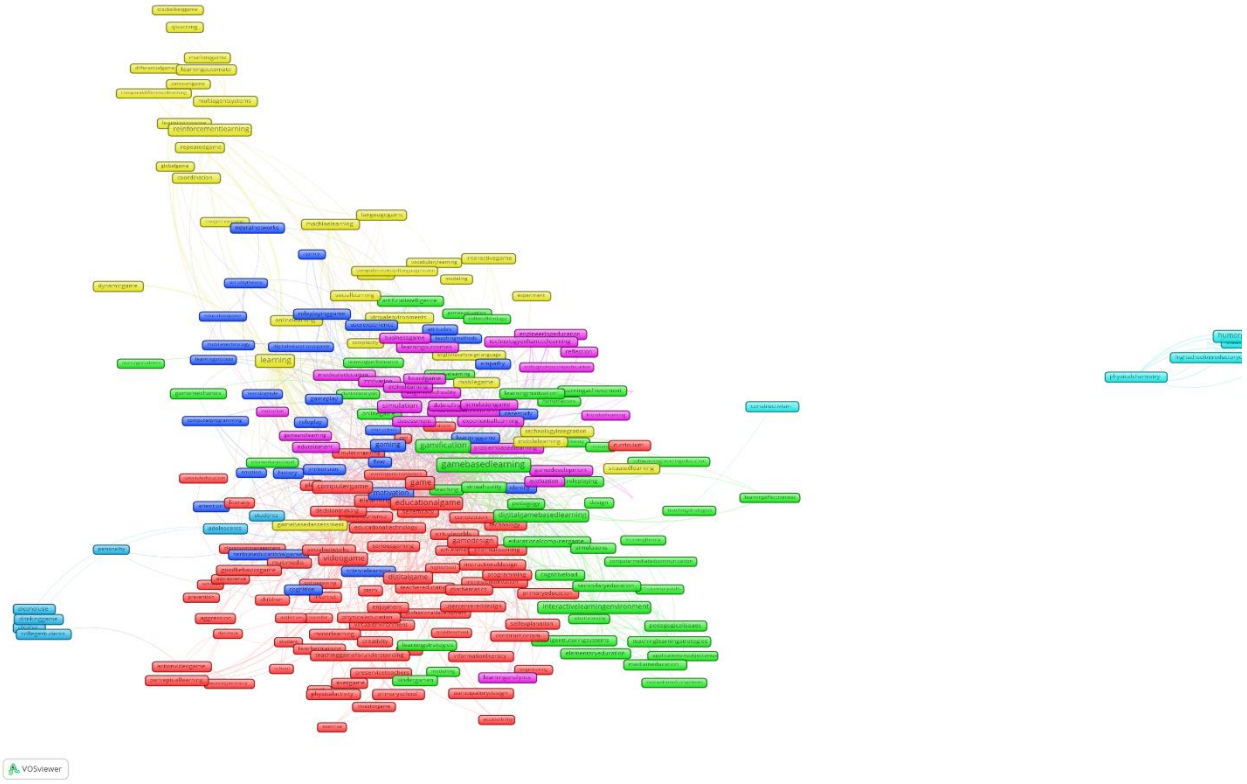

Figure 11. Keyword associational map for education – full scale version available at https://goo.gl/2kTbRR

The common trait linking these studies is the endeavour to answer the topical question as to whether games can – and actually do – improve learning processes, in terms of participants' motivation and engagement and/or learning outcomes. However, the ways authors approach this objective differ greatly, mostly due to the different viewpoints they take. In an attempt to make order out of a messy landscape (messiness being confirmed by the map of author keywords), we can try to visualize our landscape of studies on the educational use of games in a three dimensional space in which the results reported in these papers are positioned according to the focus of their studies. The axis of this three dimensional space correspond to the three main authors' viewpoints: a disciplinary viewpoint, for studies reporting outcomes in terms of learning disciplinary content, a game viewpoint, for studies reporting effects of different types of games; and a learning impact viewpoint, for studies reporting different types of learning effects. For example, Young et al. (2012) assume a largely disciplinary viewpoint, while constraining their inquiry to K12 education. On the other hand, Dicheva, Dichev, Agre,

& Angelova (2015), Merchant, Goetz, Cifuentes, Keeney-Kennicutt, & Davis (2014), and Nebel, Schneider, & Rey (2016) fall within the "game" perspective, in that they respectively focus on the effects of one specific game category or even game (respectively, gamification, virtual-reality based environments and *Minecraft*). Boyle et al. (2016), instead, consider a number of dimensions, including what they call "game genre", game purpose, subject area (which matches with the "disciplinary" viewpoint), platform delivery, study design and, last but not least, learning outcomes. This last dimension is what we later call "learning impact": we will cover various types of learning impact, using a structure similar to that adopted by Boyle et al. (2016), that is, impact on knowledge acquisition, impact on skills acquisition (including soft skills), impact from and on collaboration, social impact and impact on behaviour change. Other types of impact (such as perceptual and cognitive impact, physiological, and affective impact), being borderline between the educational and psychological perspective, are reported in Section 4.6 Psychological Perspective.

Table 3 schematically summarizes the viewpoints taken by each of the 18 core literature reviews considered (terms in italics are those used by the authors).

Table 3.Viewpoints of the core literature reviews of the educational perspective

Reviews	Viewpoints			
	Disciplinary	**Game/Game type**	**Learning impact**	**Other**
1. Abdul Jabbar & Felicia (2015)	*Science, mathematics, and language learning*	*Game type (puzzle, simulation, action, adventure, strategy, RPG, logical, first-person schooters)* *Game genre (drama, mystery, crime, fantasy, horror, science fiction)* *Game technical features (single/multiplayer, immersive, collaborative, competitive)*	*Acquisition of knowledge, application of skills, change of behaviour, emotional impact*	*Individual differences*
2. Bodnar, Anastasio, Enszer, & Burkey (2016)	*Engineering*	*Game, Simulation, gamification*	*Engineering skills*	
3. Boyle et al. (2016)	*Subject areas: science, technology, engineering and maths, health.*	*Purpose of the game and Game genre (simulations, action games, puzzles, role playing, strategy and adventure games)*	*Game outcomes divided into: knowledge acquisition, skill acquisition, perceptual and cognitive, physiological, affective, behaviour change, social and soft skills*	*Game purpose, platform delivery, study design*
4. Calderón & Ruiz (2015)	*Software project management*			
5. Connolly, Boyle, Macarthur, Hainey & Boyle (2012)	*Health, social issues, science, business, maths, statistics, engineering and computing, language and history*	*Purpose of the game and Game genre (simulations, action games, puzzles, role playing, strategy and adventure games)*		
6. Clark, Tanner-Smith, & Killingsworth (2016)		*Game mechanics characteristics, visual and narrative game characteristics*		

7. Dicheva et al., (2015)		*Gamification*	*Distinguishes between positive/negative outcomes*	*Game mechanics, platform*
8. Girard, Ecalle, & Magnan (2013)		*Video games, serious games*		
9. Hwang & Wu (2012)				*Geografical distribution*
10. Ke (2016)	*Science, mathematics, engineering, business administration, political science, reading and language.*			*Design principles*
11. Merchant et al. (2014)	*Science, mathematics, medicine*	*Virtual reality based instruction*	*Knowledge, ability or skill based outcomes*	*Grade level*
12. Nebel et al. (2016)		*Minecraft*		
13. Sourmelis, Ioannou, & Zaphiris (2017)		*MMORPGs*	*21st century skills*	
14. Wouters & van Oostendorp (2013)		*Game based learning*		*Instructional support*
15. Young et al. (2012)	*Mathematics, science, language learning, physical education, history*			
16. Wang, DeMaria, Goldberg, & Katz (2016)	*Health care professionals*			
17. Wouters et al. (2013)			*Cognitive and motivational effects of SG*	
18. Wu, Hsiao, Wu, Lin, & Huang (2012)				*Learning theory foundations*

4.5.2. State of the Art

4.5.2.1. The disciplinary viewpoint

In this section we provide an overview of the literature dedicated to disciplinary coverage that emerges from our literature review.

Boyle et al. (2016) point out that games are being used mostly in STEM (Science, Technology, Engineering and Maths) subjects. According to the same authors, health is another domain where games are often adopted, a view confirmed by the review conducted by Wang et al. (2016). Other popular subjects are by business, languages and economics (note that games and health is addressed in more detail in Section 4.6 Psychological Perspective).

Similarly, in their review concerning the positive impacts of gaming on users aged 14 years and over, Connolly et al. (2012) confirm that games for learning are being used in a wide range of subject areas, with health being the most popular, followed by social issues, science and business. The authors also examine games for mathematics and statistics, engineering and computing, language and history.

In their review, Calderón & Ruiz (2015) focus on game evaluation rather than learning outcomes. While their main interest is in computer science (and especially how games are evaluated in software programme management), they provide a comprehensive overview of game evaluation, pointing out that education and health & wellness are the most recurrent domains. In the same vein, Merchant et al. (2014) claim that games, simulations and virtual worlds are used most commonly in science, maths and medicine.

The review by Abdul Jabbar & Felicia (2015) shows that game-based approaches for primary education have been applied to a wide range of topics, including science, mathematics, and language learning.

Ke (2016) finds that games are used for domain-specific learning in various academic disciplines, including science, maths, engineering, business administration, political science and languages.

Koutromanos, Sofos, & Avraamidou (2015) reveal the majority of the papers examining augmented reality games are oriented towards science education, including environmental education, health and electrostatics.

In their review concerning the K-12 curriculum, Young et al. (2012) provide a view of subject area coverage that clashes with the fairly homogenous picture outlined so far. They report findings about the effects of video games on language learning, history and physical education, but little evidence concerning use in science and maths. This would suggest that although games are more commonly adopted in scientific disciplines, investigation of their effectiveness is more evident in humanities subjects.

As far as gamification of education is concerned, in their systematic mapping study, Dicheva et al. (2015) claim that the over-representation of STEM and computing-related disciplines might derive from the fact that teachers of those disciplines usually have higher technological skills than the 'average teacher' and therefore may be more likely to be early adopters of gamification. Bodnar et al. (2016) focus their attention on the application of gamification in the engineering disciplines, and reveal that computer software, mechanics and electronics are the most frequent content areas.

4.5.2.2. The game viewpoint

A number of authors consider and compare studies in the current literature on the basis of what they call different game genres (Bodnar et al., 2016; Boyle et al., 2016; Connolly et al., 2012; Girard et al., 2013)[9] or game types (Abdul Jabbar & Felicia, 2015), while others focus on one specific genre or type. Among the latter category, Dicheva et al. (2015) focus on gamification, Merchant et al. (2014) on virtual reality based instruction, Koutromanos et al. (2015) on augmented reality games; Sourmelis et al. (2017) on MMORPG, Nebel et al., (2016) on a single game - *Minecraft*. In some cases, authors dig deeper into the connection between game features and effects on learning, motivation and engagement, the aim being to draw conclusions that may help designers and teachers in deciding what features are more likely to ensure effectiveness in different contexts (Abdul Jabbar & Felicia, 2015; Clark et al., 2016)

9 Boyle et al. (2016) is an update of Connolly et al.(2012)

In the following we summarise the main conclusions drawn from the above mentioned literature reviews.

Entertainment games

According to Connolly et al. (2012), early studies on computer games mostly focused on the negative effects of games, while in studies covered by their review "the most frequently occurring outcomes for entertainment games were affective and motivational outcomes […], although several studies also looked at the acquisition of perceptual and cognitive skills. Physiological outcomes were only studied in entertainment games." (Connolly et al., 2012, p. 668).

The follow up of Connolly study, by Boyle et al. (2016), confirms these results, adding that entertainment games were also targeted by studies of social, physiological and behaviour change impact.

This may be due to the fact that entertainment games do not generally include curricular-specific content. However, they sometimes have affordances for learning subject-related content or relevant learning or social skills. For example, Young et al. (2012) mention how video games set in historical contexts offer students the opportunity to experience these virtually and also provide an effective context for language learning through immersion in a culture where a foreign language is used routinely to interact with others and with the environment itself. Many authors identify the strongest potential of entertainment games in affordances for improving problem solving skills (Posso, 2016), self-regulation (Monem, 2015; Sourmelis et al, 2017), reasoning abilities (Bottino & Ott, 2006), as well as general 21st century skills like collaboration and social skills (Abdul Jabbar & Felicia, 2015; Prensky, 2006; Squire, 2011). However, empirical evidence of outcomes in this regard is quite scant (Boyle et al., 2016; Sourmelis et al., 2017), possibly because of the difficulties inherent in measuring such effects, which can only be obtained through long term engagement.

Applied games

Most of the research concerning the learning effects of applied games focus on investigating knowledge acquisition or skills development, as well as engagement. Connolly et al. (2012) found that many such games were simulations or puzzle games and suggest that this may be because these learning environments have already proved

effective by previous research in Technology Enhanced Learning (Bayraktar, 2000; Rutten, van Joolingen, & van der Veen, 2012). However, there are other interesting examples where game mechanics and dynamics align closely with learning objectives, therefore making the game environments very well suited to a specific learning purpose. An example is Scratch, an environment designed for children to learn the basic concepts of programming, often regarded as an ideal introduction to the powerful concepts of computational thinking (Resnick et al., 2009). Other best practice examples concern the teaching of mathematics and science (Young et al., 2012), possibly because highly formalised content can be more easily embedded into the game design. However, Young et al. (2012) argue that in spite of this ideal alignment, little evidence of effectiveness is available,

An interesting example of how games can be used to foster the development of transversal skills, such as 21st century skills, is the game-making approach whereby learners design and construct their own digital games, often working in teams (Earp, 2015; Kafai & Burke, 2015). Collaborative game-making provides a context where "learners can work together to create something that is meaningful for them" (Bermingham et al., 2013, p. 45), allowing them to engage in a task that involves - and at the same time fosters - collaboration, problem solving, creativity and digital literacy skills.

Some studies investigate the learning affordances of specific types of games. Merchant et al. (2014) investigate the effectiveness of virtual reality (VR) based environments on learning outcomes in formal education, Koutromanos et al. (2015) review the use of augmented reality games (ARG) based on mobile devices, and Sourmelis et al. (2017) review the potential of Massively Multiplayer Online Role Playing Games (MMORPGs) for developing 21st century skills. We consider these as applied games because the object of study was their application for learning.

In their meta-analysis of virtual reality (VR) for learning, Merchant et al. (2014) point out that early applications featured very cumbersome and expensive technology. This made them largely unsuitable for school use and thus severely limited their adoption in education. Their study therefore focuses on desktop VR, comparing learning outcomes in these environments with those obtained in game-based learning environments and simulations. Their findings show that VR based instruction was quite

effective, although skill-acquisition for procedural tasks obtained negligible outcome gains. Game-based learning environments proved to be more effective than both simulations and VR environments; overall effect sizes for both knowledge and skill acquisition generated with the former were roughly twice those for the latter. They also identified some key variables that influence learning, specifically the time spent using the environment, well-planned integration into the instructional process and feedback.

Reviewing Augmented Reality Games (ARG) on mobile devices, Koutromanos et al. (2015) point out the limited number of studies performed. Most of these focus on the natural sciences and are used as part of a constructivist and situated learning approach. The ARGs involved in these studies support practice and acquisition of a range of abilities, such as scientific argumentation skills (Squire & Jan, 2007) information problem solving (Squire & Klopfer, 2007), and conceptual understanding of scientific topics (Kamarainen et al., 2013; Rosenbaum, Klopfer, Boughner, & Rosenheck, 2007). The AR features most commonly used include QR codes and in-location services via GPS.

In their review, Sourmelis et al. (2017) provide a strong body of evidence supporting the idea that Massively Multiplayer Online Role Playing Games (MMORPGs) can foster a variety of 21st century skills, especially metacognitive, communicative, collaborative and social skills, ICT skills, citizenship and leadership skills. However, other 21st century skills, such as creativity and innovation, critical thinking, problem solving, decision making and information literacy, turned out to be understudied.

Abdul Jabbar & Felicia (2015) claim that in Role Play Games (RPGs) immersion is facilitated by the fact that role-playing can improve engagement and learning. According to these authors, MMORPGs mostly support skill acquisition and can be used to incorporate collaborative learning. The competition they involve emotionally engages players and impacts on learning and motivation. Competition and collaboration often co-exist in these games and this fosters motivation, although in some cases it is motivation to play rather than motivation to learn.

Gamification

In recent years gamification has gained considerable attention in the education sector.

Indeed, in their 2014 literature review of the results from empirical studies on gamification, Hamari, Koivisto, & Sarsa (2014) noted that among the gamification studies they reviewed, the most common application context was education and learning. The authors report that while the empirical outcomes from gamification in education are mostly positive – in terms of perceived motivation, engagement and enjoyment of learning tasks – negative outcomes may also be present, for example stress due to increased competitiveness among students or distraction from learning objectives.

Gamification specifically for learning is investigated by Dicheva et al. (2015), who study the educational contexts it has been applied to and the type of design principles and game mechanics involved. The authors point out that there is no general agreement on the concept of "game element" within the commonly accepted gamification definition, i.e. the use of game design elements in non-game contexts (Deterding, Dixon, et al., 2011). The authors attempt to address this by identifying 15 different design principles and corresponding game mechanics drawn from the papers they reviewed, and map their frequency of use. They find that the most common design principles are "status visible", "social engagement", "freedom of choice", "freedom to fail", "rapid feedback" and "clear, moderately difficult goals and concrete challenges with increasing complexity". The most common game mechanics seem to be points, badges, leader boards, levels, while virtual goods and avatars appear much less frequently. Their study also contends that solid empirical research on the effectiveness of individual game elements incorporated into learning environments is still rather scarce, despite the widespread opinion that gamification has potential to improve learning.

Based on similar considerations, several authors (Abdul Jabbar & Felicia, 2015; Clark et al., 2016; Wilson et al., 2009) have sought to advance the state of knowledge about games and gamification for learning by analysing the relationship between game design, game attributes or game elements, and learning outcomes.

Wilson et al. (2009) study a number of game attributes, including fantasy, representation, sensory stimuli, challenge, mystery, assessment, and control. Based on state of the art research on games and learning theories, the authors then formulate a set of 14 propositions that research ought to address in order to relate individual game

features to different types of learning outcomes (cognitive, skill based, affective). The following are examples of such propositions:

- "as the challenge feature in a game increases, so will declarative knowledge and learners' retention of that knowledge. However, a point will be reached when too much challenge will hinder and decrease learning" (p.252);
- "Increasing the adaptation feature in a game will result in an increase in learner's cognitive strategies" (p.253);
- "As representation (i.e. fidelity) of the task in a game increases, psychomotor skill learning will also increase but then level off" (p.254);
- "The amount of control given to learners will positively affect skill-based learning" (p.255).

Abdul Jabbar & Felicia's (2015) review focuses on identifying the complexity of gaming elements for engaging gameplay and learning. Their findings suggest that virtual characters, environments, narratives and multimedia elements make the learning experience more sensory and playful; competitive play can cognitively and emotionally engage players, although girls tend to have more competition anxiety than boys; competition and collaboration often coexist but pre-existing player competences should be considered because they strongly influence gamer preferences; challenges make games play enjoyable and motivating, but can also cause frustration; control and choice facilitate attention and interest; and, last but not least, scaffolding is essential to support both gameplay and learning.

One of the most recent, large and methodologically sound among the examined studies is Clark et al.'s (2016). This meta-analysis compares game versus non-game conditions and augmented game versus standard game design, where augmented game design mostly consisted in gaming with instructor support. Although this study concerns games rather than gamification, its moderator analyses of game mechanics characteristics inform research on gamification as well. For example, the study proved that both simple gamification (where only one game element is added to traditional learning environment) and more sophisticated game mechanics proved effective. Results of this study also resonate with the findings of Wouters et al., (2013) that games

with complex narratives and sophisticated visual effects are less educationally effective than simpler games with basic narrative and graphics.

4.5.2.3. The learning impact viewpoint

In this section, we summarize findings concerning the learning impact of games, where learning impact not only refers to knowledge acquisition or skill development, but also changes in the physiological, affective, behavioural and value sphere of game users. In other words, learning is seen here as "becoming a self" (Jarvis, 2011), a different self, in the broad sense of the term. In this sense, educational games are spaces where play and learning merge, making "learning to be" possible, while traditional educational paradigms tend to focus on "learning about" (Thomas & Brown, 2009). This vision clashes with the vision of learning as serious stuff (especially from secondary school onwards), hence a separate world from play. This is borne out in the findings of (Proctor & Marks, 2013), who found that secondary school teachers had a less positive view than primary teachers about the potential of ICT and computer-based games for classroom instruction.

Before examining the specific learning outcomes that games support, it is worth returning to the very thorough and extensive meta-analysis performed by Clark et al. (2016). Although previous literature reviews have reported a lack of rigorous evidence about the effectiveness of games for learning (Perrotta, Featherstone, Aston, & Houghton, 2013; Wouters et al., 2013), results from media comparison of this study indicate that such evidence was less scant in 2016. Clark et al.'s (2016) media comparison, in fact, proved that digital games significantly enhance student learning relative to nongame conditions and that augmented game design also produces significant learning benefits. The study also reports several moderator effects: while multiple play sessions generated significantly better learning outcomes than non-game conditions, the same is not true of single play sessions; additionally, competition-less individual play and collaborative team competition showed better learning results than competitive individual play. This study, however, did not consider different types of learning effects, except for aspects of intrapersonal benefits, reported below in terms of affective impact.

Among the 18 core literature reviews, those by Boyle et al. (2016) and by Connolly et al. (2012) consider the widest range of games and a wide range of

"educational" effects of games. We therefore drew on these reviews for structuring the analysis of impacts. Boyle et al. also consider different research designs. They find that quasi-experimental design was the most common approach and was used in the vast majority of studies; randomized controlled trials were mostly used in studies of knowledge acquisition, physiological and perceptual, and cognitive outcomes; correlational design was used especially for knowledge acquisition, as well as affective and behaviour change.

Impact on knowledge acquisition

According to Boyle et al. (2016) and its predecessor Connolly et al. (2012), studies investigating knowledge acquisition and skill development were varied in terms of discipline, with a predominance of science subjects (STEM). Where randomized control trials were used, the studies prevalently found better learning results in the experimental group. The use of entertainment games figured rarely.

Impact on skill acquisition (including soft skills)

In their meta-analysis of serious game use, Wouterset al. (2013) investigated the effects of serious games on both knowledge acquisition and skill acquisition but found no significant difference between the two types, as well as little evidence of learning in general.

In Boyle et al. (2016), studies exploring skills acquisition were all in the health care sector and made use of different kinds of games: with content ranging from triage skills to cardio-pulmonary resuscitation team training. In all of these studies the use of games turned out to yield better learning results than traditional training.

Sourmelis et al. (2017) review of Massively Multiplayer Online Role Playing Games (MMORPGs) focuses instead on the so called 21st century skills, as classified in the KSAVE framework (Binkley et al., 2012). They reveal that some of these skills, such as creativity and innovation, are utterly under-investigated, while others, like critical thinking, problem solving and decision making were addressed in few studies. In particular, problem solving is often mentioned in conjunction with game-based learning, such as in Yang (2012) and Posso (2016), but few studies actually confront the challenge of assessing this skill.

Still according to Sourmelis et al. (2017), skills that are relevant to Self-Regulated Learning (SRL) such as metacognitive and learning skills have been investigated more extensively than the above. SRL-related practices commonly connected with game play include: participation in communities of practice (where players learn about game mechanics and dynamics); reflection of a metacognitive nature about strategies adopted in the game; persistence in concentration; self-monitoring; goal orientation and motivation to learn (Monem, 2015; Riemer & Schrader, 2016).

Communication skills, on the other hand, have been found to be effectively supported not only through MMORPGs (Sourmelis et al., 2017) but also in other types of immersive games (M. F. Young et al., 2012). This supports the hypothesis that their potential for immersive, contextualized learning makes them particularly suited to language learning.

As to information literacy and ICT skills, Sourmelis et al. (2017) find these are addressed in only a limited number of studies. The former mostly regard the way players search through online sources of information of various kinds to solve problems associated to the game. The latter can be fostered in three main ways: by learning technical procedures while playing together with other users, by searching external resources to learn how to perform in game activities, and by learning to code, typically within a MMORPG where coding is an intrinsic component of gameplay.

Impact from and on collaboration

Several studies focus on the role played by collaboration in games. According to Kong, Kwok, & Fang (2012), collaboration seems to increase motivation to learn rather than actually improve learning outcomes. By contrast, Wouters et al. (2013) found that collaborative game use seem to lead to better learning results than individual use. On the other hand, little is known about the effectiveness of games in developing collaborative skills. One indication on this comes from Squire & Jan's (2007) study of the augmented reality game "Mad City Mistery". Here, a role play that encouraged collaboration between students and scaffolded reading led to the development of scientific argumentation skills, i.e. communication skills that, in this context, fall within the sphere of collaboration for learning.

Boyle et al. (2016) note that in the set of papers they examined, social impact and behaviour change were aspects that were mostly investigated in the studies concerning entertainment games. Regarding games and socialisation generally, Herodotou, Kambouri, & Winters (2014) counter the claim that most players engage in gaming to mitigate their dissatisfaction with real life. In fact, gamers were found to contradict the stereotype by being highly social individuals. Similarly, Kowert & Oldmeadow (2013) found positive links between the amount of video game involvement and emotional expressivity and emotional control, thus proving that online video game involvement is not related to low degree of social skills.

On the contrary, in some contexts games are used to cultivate social bonds. For example, social video games can help hospitalised children communicate and express emotions (González-González, Toledo-Delgado, Collazos-Ordoñez, & González-Sánchez, 2014); while keeping them connect with their friends and classmates.

Social Impact

Some papers in the filtered dataset report development and evaluation of prototype social impact games addressing topics with ethical implications. One example is provided by Gilliam et al. (2016), who report evaluation of a co-designed game on sexual violence that was carried out by means of focus groups and follow-up individual interviews with teenage participants. The authors report generally positive outcomes, specifically regarding the gameplay experience as a catalyst for participant reflection and as a prompt leading them to discuss this sensitive topic with others (peers, parents, teachers, etc.). They go on to make some recommendations regarding the integration of gameplay in awareness-raising interventions designed to generate social impact (see section below).

Prandi, Roccetti, Salomoni, Nisi, & Nunes (2017) report generally positive initial outcomes from the pilot testing of a prototype gamified mobile app that combines geo-location capabilities with augmented reality features in an effort to support crowdsourced reporting of barriers to urban accessibility.

A simulation game called *Real Lives* was proved to promote empathy and interest in other cultures (Bachen, Hernandez-Ramos, & Raphael, 2012), while a virtual environment called *Dread-Ed* was used to develop social skills for disaster

communication in a safe environment (Haferkamp, Kraemer, Linehan, & Schembri, 2011).

Impact on behaviour change

Effects of games on behaviour have mostly been studied focusing on entertainment games (Boyle et al., 2016). A wealth of studies concerns video game violence and its impact on aggression and aggressive/violent behaviour (Anderson, 2004; Anderson & Bushman, 2001; Christopher J. Ferguson, 2015; Christopher John Ferguson, 2007; Greitemeyer & Mügge, 2014). This aspect is dealt with in more detail in Section 4.7 devoted to the Ethical Perspective, therefore here it is worth mentioning only that although the results of some meta-analyses suggest that there is no such influence (Christopher J. Ferguson, 2015; Christopher John Ferguson, 2007), according to most other analyses of this aspect playing violent games does seem to increase aggressive behaviour (Anderson, 2004; Anderson & Bushman, 2001; Greitemeyer & Mügge, 2014). In addition, according to meta-analytic study by Greitemeyer & Mügge (2014), playing video games with prosocial content seem to foster prosocial behaviours.

As far as serious games are concerned, several examples are reported in the considered literature of serious games developed and tested to foster behavioural changes in the healthcare sector. These include *Guardian Angel*, a computer simulation game (Verduin, LaRowe, Myrick, Cannon-Bowers, & Bowers, 2013) aimed at increasing relapse prevention skills in outpatients on a substance abuse treatment program and *TAKO DOJO*, a game addressing the therapeutic adherence of diabetic patients (D'Aprile & Severino, 2016). Schönbrodt & Asendorpf (2011) studied the effects on real-life behaviour of interactions with a virtual spouse in a virtual environment, finding that there is some sort of transference between the real world and the virtual world.

For analysis of the reported impact on other learning-related spheres - perceptual and cognitive, physiological, affective, and behavioural - see Section 4.6 Psychological Perspective.

4.5.3. Recommendations

In this section, we summarise the main recommendations that emerge from the studies

concerning the educational perspective of this literature review. Considerable research effort has been devoted to providing proposals and guidance about the effective use of games to support learning. Most of those studies have focused on a specific game type in the context of purposeful gaming, that is Serious Games, and have provided interesting recommendations, in terms of both general guidelines and specific references for the implementation of serious games in education.

General recommendations

Tsekleves, Cosmas, & Aggoun (2016) offer a very comprehensive analysis with both general and specific recommendations. The authors point out how, in spite of recent growing interest in the literature on serious games and game-based learning, few substantial recommendations for the effective inclusion of serious games in education have been formulated, or for supporting all key stakeholders with a role in facilitating that inclusion. They propose a number of general recommendations steering the adoption of serious games in education:

- policies for the adoption and the incorporation of serious game in formal education should be defined;
- a globally accepted policy for the definition of serious games in education - such as a common definitional terminology to be widely adopted - should be formulated;
- a common policy for the adoption and use of the Problem Based Learning (PBL) methodology for the design and development of serious games should be established;
- an educational serious game content rating system, similar to that of the Pan European Game Information (PEGI), should be developed to facilitate serious game producers with a code of conduct and to offer clear guidance to developers and educators, as well as to users of serious games. Such information should be provided using a visual language;
- more funding should be provided by governments and research councils for pilots and research studies on the effectiveness of serious games across all fields, subjects and levels of education.

In addition to this last point, the authors suggest the designation of a commission of longitudinal research on the subject of the transfer of tangible serious game outcomes outside the game context. This should then inform policy in consultation with a range of stakeholders on the alignment of serious games in the curriculum across all levels of formal education. Meanwhile, an institutional and regulatory framework could be established - locally or at a national level - to guide the use of serious games in formal education contexts not in isolation but as part of a blended learning strategy.

The recommendations that authors make also address specific stakeholder groups: developers (including game industry professionals), educators, policy makers, and researchers. Some recommendations concern multiple stakeholder groups. With regard to this cross-cutting aspect, Young et al. (2012) encourage support for collaborative partnership among stakeholders, i.e. commercial game companies, educational researchers, teachers, administrators, policy makers and parents.

Developers

Most of the recommendations for developers are formulated in terms of broad suggestions about how to organize and design the learning content, the domain coverage and the narrative of serious games/games for learning. In this sense, Wouters et al. (2013) recommend that developers of serious games should concentrate more on designing the learning content and domain, and less in solving visual design issues. This is because research results suggest that schematic serious games are more educationally effective than cartoon-like or realistic games. Moreover, Wouters & van Oostendorp (2013) suggest that game mechanics, game content and learning content should be seamlessly integrated. In a general manner, Bodnar et al. (2016) recommend that developers should pay more attention to learning-theory foundations in game design. Moreover, Abdul Jabbar & Felicia (2015) recommend that game design should be connected with multiple learning tools and engaging tasks and materials that speed up and support students to explore and complete gaming and learning activities in accordance with their needs and abilities.

With regard to game narrative, Wouters et al. (2013) recommended that developers should consider the impact that embedding narrative has on learning gains in serious games/games for learning. Developers usually add narrative events to enhanced

gameplay and engagement, while Wouters et al.'s (2013) study results suggest that serious games without a narrative are more effective than those with a narrative. This could be because narrative events require players to overuse their cognitive capacity for processing information not strictly related to the learning content. Wouters & van Oostendorp (2013) recommend that, if a narrative is educationally relevant, then different approaches should be considered for overcoming cognitive overload: aligning narrative with learning goals; seamlessly integrating game content, mechanics and narrative; or altering the order of narrative events. Also, they recommend aligning the narrative theme with instructional support and applying the latter to foster cognitive skills and knowledge acquisition rather than stimulating in-game performance. As to integrating learning content in the narrative layer, Ke (2016) recommends that the impact on the play experience should be scrupulously considered in terms of extraneous cognitive load to be processed.

Boyle et al. (2016) recommend that both visual design and narrative should prioritise effectiveness over richness. They consider that this aspect also applies to researchers, who should report visual design more thoroughly. Furthermore, to enhance learning affordance, developers should concentrate on designing rich, multifaceted game experiences.

Merchant et al. (2014) draw on research studies suggesting that students learned better when learning simulations were used in the form of practice sessions than when they were used in a stand-alone format. On this basis, they recommend that (instructional) designers should consider the design of virtual reality-based instruction in terms of how it is being used in the context of other instructional modes. Moreover, designers should consider assessment strategies so that students' ability to apply a concept can be assessed in a context different from the one in which they were instructed.

Ke (2016) recommends that developers should consider the nature of the domain knowledge and the targeted type of learning in game design. Moreover, the design of game-based content interactions should be aligned with the target learning objectives and therefore the major learning functions of the game. The author also suggests that developers, in designing (meta-reflective) scaffolds, should opt for non-intrusive, adaptive and dynamic learning support tools to avoid extra cognitive load. Such

scaffolds should be implemented as part of core game actions and strategies rather than being segmented from the gameplay.

Further detailed recommendations for developers (i.e. designers) of serious games in education are proposed by Boyle et al. (2016), with particular regard to the importance of design (and careful reporting of that design) for both game and nongame conditions and the importance of including assessments designed to measure deeper understanding in future research. Designers should seek to integrate/leverage learning oriented enhancements in games, especially for enhanced scaffolding. Finally, designers should avoid proposing single-player competitive games, based on research results showing that single non-competitive games are most effective, even more than multi-player and collaborative games.

Another specific recommendation from Tsekleves et al. (2016) refers to serious game design workflow, in terms of collaboration among different stakeholders. The authors recommend encouraging and facilitating the co-design of serious games in education through the formation of co-design pathways between learners, educators, game designers and developers across education levels (primary, secondary and higher). Boyle et al. (2016) also stress the need for game designers and education researchers to collaborate on designs to keep game graphics, environments, and narratives optimally aligned with assessed learning objectives.

Tan, Johnston-Wilder, & Neill (2010) offer an interesting analysis - although limited to Malaysia - on the perceptions of game industry professionals towards the use of games in education. The authors recommended that practitioners should collaborate with teachers in designing and developing games used in education. Collaboration should be in terms of communication, selection and maintenance of objectives, respect for each other's professionalism, alertness to social trends and the latest technology, support from experts in other fields, and middle-level coordination.

Similarly, Abdul Jabbar & Felicia (2015) recommend collaboration among game professionals and researchers in game based learning initiatives, supported by means of long-term collaboration protocols.

Alklind Taylor (2015) recommends that infrastructures such as best practice communities should be created to facilitate knowledge management and sharing among

educators at different levels; to enhance their professional practice, educators should then be provided with a research dimension and with structures helping them with both pedagogical and technical issues. From the technical viewpoint, (intelligent) tutoring systems or pedagogical agents should support human educators. Secondly automatic assessment systems should be implemented into the game, thus relieving some of the cognitive workload of educators. Thirdly, from the Human Computer Interaction viewpoint, teams of educators should be involved in game production by implementing distributed scenario authoring tools.

Educators

Most recommendations for educators concern general proposals about how to integrate and utilize serious games in learning activities.

Wouters et al. (2013) recommend that educators should couple serious gaming with other learning activities when seeking to integrate purposeful gaming in the classroom. Furthermore, the same authors suggest that educators should spread serious game play over multiple sessions rather than limiting them to a single block, since their research results show this to be more effective. They also found that group game play led to better learning outcomes, even though the authors find evidence to the contrary in their study of GBL instructional support (Wouters & van Oostendorp, 2013). Finally, with regard to adoption in different learning domains, educators should not always prioritize STEM, as research studies suggest serious games are particularly effective in language learning,

Wouters & van Oostendorp (2013) suggest that, if a wider variety of game genre is to be used in learning, educators should be provided with a better guidance about how the affordances of different kinds of games can support learning in different ways. According to the authors, it is essential for educators to develop a better understanding of the tasks, activities, skills and operations that different kinds of game can offer and examine how these might match desired learning outcomes.

Merchant et al. (2014) recommend that teachers should be well informed about the features and situations that make feedback effective. As the authors affirm, when learning tasks are declarative in nature, an elaborate explanation type of feedback is more effective.

Tsekleves et al. (2016) recommend that when commercial off-the-shelf games are used in the classroom for learning purposes, they should closely align with relevant learning objectives and include metagames and ad hoc designed assessments. In the longer term, specific efforts should be dedicated to making serious games more accessible to schools, by means of proper policy actions. To foster the adoption of serious games in learning activities, educators should be provided with a central repository of quality non-commercial serious games along with teaching and learning objectives and best practices, which could be used to get ideas and document/share their experiences. Finally, with regard to the important question of assessment, the authors recommend that inbuilt scoring should not be used as a learning performance metric for commercial off-the-shelf games. They recommend, instead, that external assessment should be implemented and utilized to support learning reflection. Wherever possible, embedded assessment should be employed to provide additional learner performance metrics.

Alklind Taylor (2015) proposes detailed recommendations for educators in terms of challenges and pitfalls they need to be aware. In the author's opinion, since educators shift between different roles during serious gaming (facilitator, debriefer, coach, player, leader, expert, etc.), it is important not to treat them as having only one role. Moreover, the author recommends consideration of three main dimensions - organisational, technical, and Human Computer Interaction (HCI) - for the professional development of educators dealing with serious gaming. This would help increase their levels of expertise beyond the pedagogical and the technological knowledge and allow them to implement valid solutions for facing the challenges in classroom-based serious gaming.

On the design of game-based learning activities for students, Abdul Jabbar & Felicia (2015) recommend that educators consider calibrating gaming activities to students' knowledge, needs and abilities (gender, game type preferences, preferred mode of gameplay, abilities). The authors, based on previous research studies, also suggest that educators should check for appropriate feedback and scaffolding mechanisms when selecting games for learning.

Policy makers

As already mentioned, recent research studies also offer recommendations for policy

makers. In particular, since research in the digital game-based learning sector has significantly increased in recent years, policy makers should take this trend into account when making plans for supporting the development of educational game industries (Hwang & Wu, 2012). Policy makers (in cooperation with both developers and researchers) should be aware of digital game-based learning coverage (in terms of countries, contexts of use, disciplines, etc.).

Some authors (Tsekleves et al., 2016) provide more detailed policy recommendations for governments, which should create conditions for improving opportunities of collaboration between educators, researchers, educational bodies, game developers and learners. This could reduce the high cost and technical issues associated with effective serious games development and make them more affordable and accessible to educational institutions. Merchant et al. (2014) suggest that educational institutions should be more willing to invest time and financial resources on virtual reality-based instruction (game-based learning environments, simulations, and virtual worlds), based on the results of their meta-analysis, that corroborates the hypothesis that such environments enhance learning outcomes. Tsekleves et al. (2016) also recommend that governments and research councils should allot more funding for pilots and research studies on the effectiveness of serious games across all fields, subjects and levels of education. In addition, they advocate changes to computer game copyright laws in order to facilitate licensing for the adoption of commercial games in education (Tsekleves et al., 2016).

Researchers

Recommendations for researchers are mostly in the form of suggestions for future research (in terms of open issues) and mainly deal with the issue of providing more rigorous and structured evidence (in terms of research methodologies/methods) about the impacts of games in learning.

With regard to the first aspect, (Ke, 2016) suggests that more (focused) research should be done on some specific research topics such as: suitable (meta-reflective) learning scaffolds that do not compromise game experience; salient game attributes and their impact on learning outcomes; and the role of individual learner characteristics and adaptivity. Merchant et al. (2014) recommend further research on the possible benefits

of collaboration in simulations. Boyle et al. (2016) recommend more empirical investigation should be done on the real impact of multiplayer collaborative/competitive gameplay, since research studies suggest questionable results.

With regard to this last aspect, Connolly et al. (2012) underline the need for more robust research studies on the implementation of serious game in education. In particular, the authors recommend that researchers should carry out more RCTs (Randomized Controlled Trials) and more qualitative studies of affective and motivational outcomes. Similarly, Dicheva et al. (2015) stress the need for more empirical research on the effectiveness of gamification in learning. Young et al. (2012) recommend conducting longitudinal studies that examine the impact of educational video games, and constructing working definitions to facilitate the separation of video games and simulations. Furthermore, the authors recommend establishment of an educational video game repository for researchers, in line with the proposal from Tsekleves et al. (2016). Bodnar et al.(2016), focusing on game-based learning in engineering education, stress the need for more outcome data and systematic studies of outcomes, both qualitative and quantitative. They also suggest future research should be more transparent so that interested educators can contribute to the literature as well as attempt to replicate results. Boyle et al. (2016) recommend special attention should be paid to methodological rigor in research on games for learning. Moreover, they propose that researchers should carefully weigh the benefits of experimental designs and – in the case of quasi-experimental design-based studies – provide more substantial information about the group attributes.

Tsekleves et al. (2016) suggest that researchers should publish serious game design guidelines and principles, based on rigorous research of the literature that synthesises the most effective guidelines for education and make this available in an accessible visual format along with examples of use.

In the particular case in which researchers are also involved in learning game development, Ke (2016) recommends they should provide a phenomenological description of their development experiences, by elaborating on the theoretical underpinnings, overarching design strategies, design rationales for game mechanics and the game world design, and key lessons/tips.

Finally, some authors stress the importance for researchers to collaborate with other stakeholders. For example, Abdul Jabbar & Felicia (2015) recommend that researchers should collaborate with participants to identify matters that contribute to (or decrease) engagement and should then propose suitable elements to foster engagement and learning. Boyle et al. (2016) underline the need for education researchers and game designers to collaborate on designs to keep game graphics, environments, and narratives optimally aligned with assessed learning objectives.

4.5.4. Conclusive remarks

During the last decades, many studies have supported the hypothesis that the use of games for learning leads to better learning, higher motivation and better performance. However, until recently, researchers who have engaged with literature reviews and meta-analyses of gaming for learning have been very cautions in drawing conclusions in support of games effectiveness for learning mostly because they found rather scant empirical evidence of such effectiveness (Girard, Ecalle & Magnant, 2012, O'Neil, Wainess, & Baker, 2006; Perrotta et al., 2013). In 2016, Clark et al.'s (2016) extensive meta-analysis was published, supporting the claim that today empirical evidence is less scant than it used to be. Research on the educational benefits of gaming in general, and of serious games in particular, often intertwines with research on their effects on motivation, on the assumption that games support learning because they are motivating and engaging (Prensky, 2001). Although motivation is, in this review, dealt with in the section dedicated to the Psychology perspective, we feel it is appropriate to mention here that this causal relationship between motivation and learning does not emerge clearly from our core set of papers. In particular, the meta-analysis by Wouters, van Nimwegen, van Oostendorp and van der Speck (2013) on the cognitive and motivational effectiveness of serious games found that while the games they examined were more effective in terms of learning and retention than traditional methods, they were not more motivating. Other studies (Connolly, 2012; Boyle et al, 2016), instead, found that games have potential for both learning and motivation or engagement. However, none of the core studies examined here provides evidence of a causal relationship between motivation and learning in games. In any case, although proving impact on learning is important, the value that games may bring in terms of the

strengthening of motivation and engagement should not be underestimated: there are many learning contexts where these effects are almost as important as learning outcomes. School, for example, is one such context.

Of course, even considering the most recent optimistic results in terms of learning, we should not forget that empirical evidence usually regards the use of a game in a given context and results cannot be generalised to any game in any context (Hays, 2005; M. F. Young et al., 2012). In addition, what may be true for one cohort of learners may not be true for other learners. The one thing that most authors agree upon is in fact that more research is needed to investigate the way acceptance and effectiveness of game-based learning approaches relates, on one hand, to the games features and, on the other, to the learners features, such as personality, culture, genre, and learning style (Abdul Jabbar & Felicia, 2015; Clark et al., 2016; Perrotta et al., 2013; M. F. Young et al., 2012).

The specific recommendations made by the authors included in this state of the art review strongly converge around the need for close(r) collaboration among the different stakeholder groups with an interest in game based learning: commercial game companies, game developers, educational researchers, teachers, administrators, policy makers and parents (Boyle et al., 2016; Tan et al., 2010; Tsekleves et al., 2016; M. F. Young et al., 2012). Specifically, collaboration between developers, researchers and teachers in the game design process is held to be a priority, especially regarding the design of purposeful games and gameful interactions for learning. Here, authors stress the need to prioritise the seamless integration of game mechanics, game content and learning content, ensuring these are functional to educational objectives (Abdul Jabbar & Felicia, 2015; Boyle et al., 2016; Ke, 2016; Wouters et al., 2013).

While recognising the contribution that immersive environments and game narratives make to player engagement, some authors warn that - when it comes to knowledge acquisition - these aspects may actually prove to be an unwarranted distraction and may increase cognitive load unduly (Boyle et al., 2016; Ke, 2016; Wouters et al., 2013). One recommendation for addressing the cognitive load issue is to scaffold learning in core game actions via non-intrusive, adaptive and dynamic learning support that - ideally - encourage meta-reflection without compromising game experience (Boyle et al., 2016; Ke, 2016).

Author recommendations also focus on the pivotal role of the educator in ensuring game based activities align adequately with learner needs and educational objectives (Abdul Jabbar & Felicia, 2015). Some call for better support for teachers, especially given the multiplicity of roles that GBL calls on them to assume: facilitator, debriefer, coach, player, leader, expert, etc. (Alklind Taylor, 2015; Wouters & van Oostendorp, 2013). Specific recommendations regard the allocation of gameplay across multiple sessions and integrating it with other learning activities (Wouters et al., 2013). Regarding game selection, some suggest that competitive games may not be as effective non-competitive ones when it comes to knowledge acquisition. Alignment between the key learning functions of the game and target learning objectives is also considered important (Tsekleves et al., 2016).

In their recommendations on the GBL research agenda, authors mention a number of issues warranting further investigation such as better understanding of salient game attributes and their impact on learning outcomes, the role of individual learner characteristics and adaptivity, the role of meta-reflection, the possible benefits of collaboration and the real impact of multiplayer collaborative/competitive gameplay (Boyle et al., 2016; Ke, 2016). More empirical research on the effectiveness of gamification in learning is also urged (Dicheva et al., 2015), as well as more longitudinal studies of outcomes (M. F. Young et al., 2012).

Turning to how GBL research itself is performed and reported, some authors recommend closer attention to the choice and execution of experimental designs (Boyle et al., 2016; Connolly et al., 2012). More substantial information about group attributes in gaming activities is called for, as well as phenomenological descriptions of game development experiences that elaborate on theoretical underpinnings, overarching design strategies, and design rationales for game mechanics (Ke, 2016); some hold that this information could contribute to the formulation of serious game design guidelines and principles (Tsekleves et al., 2016).

The call for the research community to consider phenomenological descriptions of the game development process is extremely interesting when we consider that the documentation and sharing of design ‘post-mortem’ is an established practice in the community of entertainment game developers. This recommendation falls fairly and

squarely within the mission of GH to explore the space between academia and the commercial gaming sector.

4.6. *Psychological Perspective*

4.6.1. Methodological Specificities

This section of the deliverable focuses on the psychological perspective on gaming. The core set of papers analysed comprises the 29 literature reviews selected according to the criteria described above in Section 4.3 Methodology for the analysis of the academic perspectives for the analysis of the academic perspectives. The scope was subsequently widened to include other papers present in our dataset, as well as key papers cited by those included in the review and others retrieved from supplementary targeted queries through Google Scholar.

As also mentioned in the Methodology section, we examined an associational map of author keyword occurrences for items in the dataset (see Fig.12).

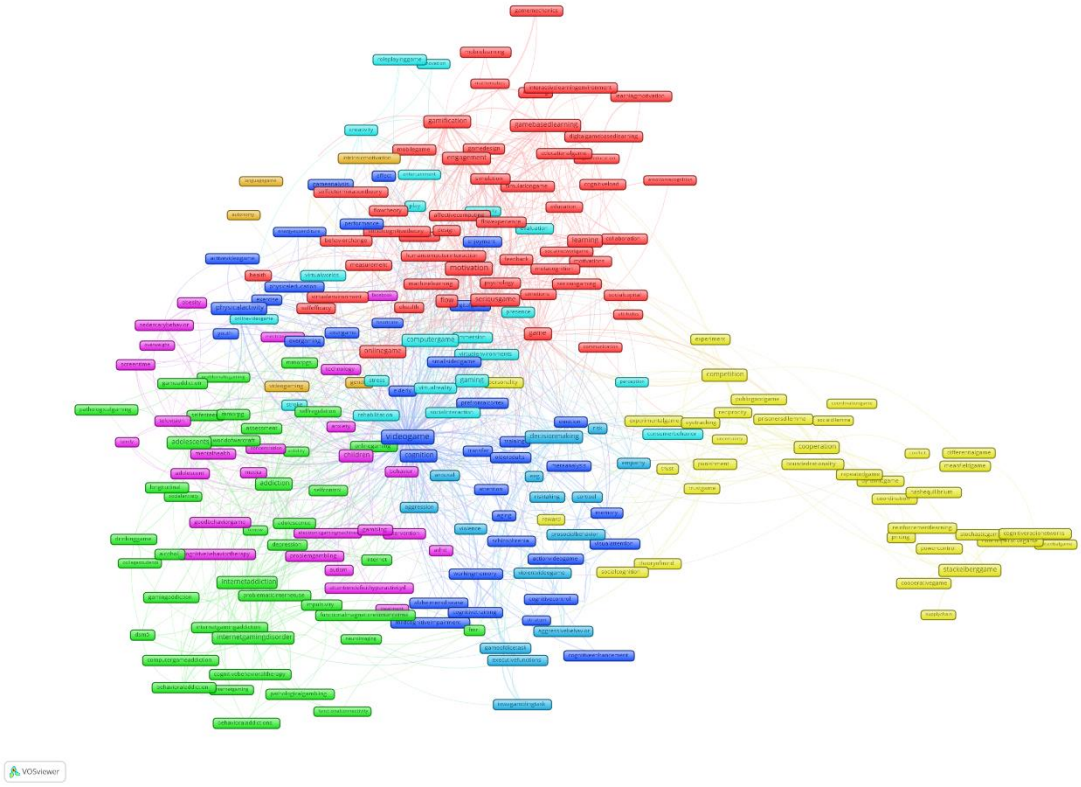

Figure 12. Psychological perspective keywords associational map. Zoomable version available at https://goo.gl/5BR2ie

The keyword map shows associations between author keywords in the unfiltered database (5774 items). Only keywords occurring in at least 12 items (i.e. 0.2% of the corpus) are included in the network. Visual examination of the network yields several insights into the key research topics in the field, namely:

- A first cluster (cyan), at the centre of the map, contains the keywords immersion, virtual reality, presence, gaming. A section of this review will focus on immersion specifically (closely related to research on motivation and engagement -- red cluster). (Section 4.6.2.1 Immersion)
- A neatly separated cluster of keywords (red cluster) pertains to the study of motivation, engagement, game based learning and flow. Our review will examine papers focusing on these topics (Section 4.6.2.2 Motivation and Engagement). Gamification turned out to be one of the keywords belongings to this cluster; this is probably due to the close link between the research on gamification and motivation. For this reason, it will be discussed

immediately after the Motivation and engagement section (Section 4.6.2.3. Gamification)

- Another neatly separated cluster (green cluster) contains keywords related to internet gaming disorder, internet addiction, MMORPGs, and adolescents. Thus, a specific section of the review explores the theme of addiction (Section 4.6.2.4. Addiction).
- A fourth cluster (dark blue) contains keywords concerning aging, working memory, cognitive control, cognitive training, cognition, older adults, exercise and exergaming. This cluster (presumably) contains the work done on cognitive and physical benefits of gaming, a field of research that is especially related to interventions for older adults. Two sections of this review focus on these topics - one on cognitive benefits, and the other on the application of video games for the rehabilitation and training of older adults. (Section 4.6.2.5 Perceptual and cognitive impact and Section 4.6.2.6Training in Older Adults)
- A fifth cluster (violet cluster), seems a little more heterogeneous and contains words related to health (sedentary behaviour, screen time, obesity, mental health), to development (children, ADHD, autism, family, adolescent), and to addiction (problem gambling, intervention treatment). A section focusing on the health impact of video games (mostly studied on children and teens) is also included in the review (Section 4.6.2.7 Impact on Health)
- A sixth cluster (light blue), which is closely intertwined with the previous one, contains keywords like violence, arousal, violent video games and aggressive behaviour. This topic is examined in Section 4.7 - Ethical Perspective, including the contribution to the field from the psychological perspective.
- The final cluster (yellow) contains several keywords that are outside the scope of the review, and likely appear because of the use of the term “game” outside the field of study on games and gamification. Specifically, “Stackelberg game”, “stochastic game”, and “repeated game” label papers

dealing with game theory and not with video games. No section of the review will be dedicated to this topic (although a few keywords included in this cluster, such as competition, trust, and social cognition will be examined in the ethical perspective section).

4.6.2. State of the Art

4.6.2.1. Immersion

Attempts to understand player motivation often employ the term 'immersion', particularly in relation to its motivational impact on player experience (e.g., Billieux et al., 2013; Jennett et al., 2008; Yee, 2006). Immersion is often framed within the context of engagement as a means of describing an individual's presence in a game's virtual world. Again, definitions differ. Jennett et al. (2008) acknowledge uncertainty around the meaning of the term, nevertheless suggesting that it describes the possibility for a player to "lose themselves" (p. 2008) in the gameworld. Yee (2006) suggests that the 'immersion component' of motivation (p. 773) includes multiple aspects, such as player discovery, role-play, customisation and escapism. Merhi (2016) elaborates on this escapism dimension, further differentiating between players who seek immersion to "kill boredom, achieve a specific objective, have fun" and those who wish to "develop a desire that they cannot accomplish in reality" (p. 225).

Elsewhere, immersion is related to Csikszentmihalyi's (1990) theory of flow, which describes the "rewarding, subjective, emotional state of optimal pleasure" (Boyle, Connolly, Hainey, & Boyle, 2012, p. 772) generated by absorption in a task. Definitions of flow note that this state is often accompanied by a "distorted sense of time" (Jennett et al., 2008, p. 642), as players lose track of the world around them. Boyle et al. (2012) also acknowledge that flow refers "only to states of optimal experience" (p. 778). As such, Jennett et al. (2008) propose that flow overlaps with, but differs from, immersion as the latter provides a "graded experience" (p. 642) rather than the "extreme" state offered by the former. In other words, flow could be understood as a particular kind of immersion. However, others (Hou, 2015; Kiili, 2006) suggest that flow can also be conceptualised on a scale with different levels of gradation. Jennett et al. (2008) also liken immersion to Cognitive Absorption (CA), suggesting that CA relates more generally to technology use, whilst immersion relates specifically to video game play.

Given the above, this section employs a broad definition of the term immersion, considering work that deals with all of these concepts.

However it is conceptualised, immersion is positioned as having both positive and negative implications and associations. Jennett et al. (2008) suggest that immersion is critical to game enjoyment (p. 641), and therefore an important concept for game designers. Merhi (2016) suggests that flow and enjoyment are intrinsically related, albeit finding that flow experience did not significantly impact on player's intention to play online games. On the other hand, Billieux et al. (2011) suggest that immersion as a motivation for gameplay can be problematic and lead to "tangible negative consequences in daily life" (p. 165) stemming from the related lack of physical activity, neglect of friendships or responsibilities outside of the game. Similarly, Yee (2006) suggests that the escapism dimension of immersion can lead to player avoidance of real life problems (p. 774).

Approaches to examining immersion vary across the literature, exploring it for different purposes and in differing contexts, often in smaller scale studies. For instance, Przybylski, Weinstein, Murayama, Lynch, & Ryan (2012) describe a close relationship between immersion and identity play, relating to players' notions of the ideal self. They theorise that immersion via performance of an appealing in-game role provides a significant motivation to play, whilst also acknowledging the lack of reliable research that explores the impact of this kind of play on individuals' construction of self. Schmierbach, Limperos, & Woolley (2012) found that generating more realistic physical interaction with a racing video game, through the provision of a steering wheel interface, helped to amplify perceived levels of player immersion in the gameplay. In a study of social games, Cairns, Cox, Day, Martin, & Perryman (2013) concluded that immersion was increased when the opposing player was human rather than computer generated, regardless of whether players were co-present or remotely located. Smith, Gradisar, King, & Short (2017) link flow states with longer video game play times for children.

A number of studies exist where immersion is seen as a state with a potential for learning experiences. Hou (2015) considers immersion in role-playing simulation games in relation to science learning, surmising that higher levels of flow were positively correlated with increased levels of self-reflection. Faiola, Newlon, Pfaff, & Smyslova

(2013) explore flow in relation to the concept of telepresence, understood as the experience of feeling present in the virtual space. In an attempt to unpick the relationship between these concepts and their contribution to learning in video game environments, they theorise that attaining a state of flow results in an optimal learning attitude during virtual game based learning by increasing the feeling of telepresence. They propose that establishing virtual environments where flow is possible therefore has the "power… to drive advances in commerce and education" (p. 1120).

From the literature considered here, it is clear that there is a belief that games provide motivating and immersive experiences for players, due to particular aspects of their characteristics and players own motivations. What is less clear is exactly how to generate these immersive and engaging experiences, or how to ascertain their wider value or implications for players.

4.6.2.2. Motivation and Engagement

Issues around motivation appear throughout the literature, which often cites the mass appeal of entertainment games as a sign of their motivational pull on players (Billieux et al., 2013; Przybylski, Rigby, & Ryan, 2010). There is an interest in understanding what it is about games that is motivating - making them 'acceptable and attractive' (Merhi, 2016, p. 260) or even 'alluring' (Przybylski et al., 2012, p. 74) - and how this motivating influence manifests as player experience. Across this literature, constructs of motivation and engagement are closely related and flexibly defined, perhaps indicating that "definitional agreement regarding how to label subjective experience during video game-playing has not yet been achieved" (Brockmyer et al., 2009, p. 624). For instance, whilst Brockmyer et al. (2009) use engagement to mean "a generic indicator of game involvement" (p. 624), Boyle et al. (2012b) suggest that "many accounts view enjoyment of games as almost synonymous with engagement" (p. 778). The fact that the terms 'motivation' and 'engagement' are also often conflated in the literature makes it difficult to conclusively differentiate between these strands, hence the intention to consider them together in this section. Both motivation and engagement around gameplay are framed positively and negatively; whilst, for example, Janssen et al. (2017) explore motivation as a positive feature in rehabilitation involving gamification, Xu, Turel, & Yuan (2012) investigate motivation in relation to addiction, as a means of pursuing 'harm reduction' (p. 323). Although engagement is perhaps more frequently

considered a positive state either to be attained (in the case of the player / participant) or propagated (in terms of the design of game or digital tool), there are studies that consider 'problematic engagement' (Billieux et al., 2011, p. 170), with engagement being perceived as unhealthy or undesirable when it "turns into habitual play or even addiction" (Boyle et al., 2012).

Much of the recent literature considers motivation as a strand in the research, rather than making it a focus or a starting point. A notable exception is Boyle et al. (2012), who provide a systematic review of literature around engagement, in relation to the broad category of entertainment games. They suggest that video games are often understood as "highly engaging activities" (p. 771), acknowledging that little is understood about the nature of this engagement, in spite of a recent "surge of interest" (p. 777). They identify six different methodological and theoretical perspectives taken across fifty-five diverse papers that relate in some way to gaming and engagement. Given the scope of the studies under examination, and the broad range of methodological approaches used to measure motivation, it is perhaps not surprising that their conclusions emphasise that engagement in gameplay has multiple, complex dimensions, including the social and emotional aspect of gameplay, alongside the nature of the gaming experience or environment. Nevertheless, the papers they consider, and those brought to light by our own literature search, provide some insightful findings in relation to engagement.

Across this literature there are interrelated concerns, in a number of different contexts, around what motivates players, and what this engagement looks (and feels) like, an exploration of the latter providing a means of understanding the former. This manifests in a focus on how the game itself is implicated in the motivation or engagement of players, specifically in terms of the game mechanics or the play environment it provides. For instance, Merhi (2016) found that the visual appeal of online games was positively related to players' motivations to play. Similarly, Ivory & Kalyanaraman (2007) identified that player engagement (conceptualised here through their feeling of involvement in a game) increased in correlation with the realism provided by the game environment, although it should be noted that this result is in contrast with Clark and colleague's meta-analysis results (Clark et al., 2016). Competition is also cited as a motivational factor (Billieux et al., 2013; Boyle et al.,

2012; Lucas & Sherry, 2004; Nebel et al., 2016). Specifically, Weibel, Wissmath, Habegger, Steiner, & Groner (2008) surmised that playing against a human participant, rather than a computer generated one, potentially increased player engagement.

Whilst competition with others involves challenge, a game's ability to include *appropriate* challenge, and therefore a sense of achievement for the player, is also considered to be a motivating factor. This is sometimes understood as the 'achievement component' of motivation (Yee, 2006, p. 773). There are multiple studies demonstrating how players are likely to be more engaged in a game if the level of challenge is appropriate to their ability levels (e.g. Boyle et al., 2012; Fang, Lin, & Chuang, 2009; Merhi, 2016), with the concept of 'optimal challenge' (C. Liu, Agrawal, Sarkar, & Chen, 2009, p. 507) describing the level of challenge that generates optimum engagement. This is often invoked alongside the concept of 'flow' (Csikszentmihalyi, 1990) as 'optimal experience', which has been already addressed in this review (see Section 4.6.2.1 Immersion). Meanwhile, Przybylski et al. (2012) focus, perhaps less tangibly, on the "potential of video games to put players in touch with ideal aspects of themselves" (p. 74). Such studies also illustrate the difficulty of isolating intrinsic motivation from extrinsic factors that the player brings to the game. Indeed, as Yee (2006) acknowledges, "the same video game may have very different meanings or consequences for different players" (p. 774).

With this in mind, a number of papers also consider motivation as something that comes from the individual player; this player motive could be considered as a precursor for motivation, sometimes positioned as 'intrinsic motivation' (Przybylski et al., 2012, p. 69). Again, motives are seen as complex and heterogeneous (Billieux et al., 2013, p. 103). Sometimes motivation is identified as growing from players' pre-existing associations with a particular game or brand, with Wu, Wang, & Tsai (2010) likening this loyalty to 'falling in love' with the online game (p. 1862). Particularly in relation to games, such as MMORPGs and other virtual world environments that afford remote connectivity between players, this social aspect is found to be a significantly motivating factor. Billieux et al. (2013) offer a longitudinal study focused on the motivations of World of Warcraft Players, finding that socialisation was a significant motivation for playing this particular type of game. Similarly, drawing on a survey of 3000 MMORPG players, Yee (2006) cited socialising, relationships and teamwork as important aspects

of the social component of motivation. Merhi (2016) study of online games also cites socialisation as a motivational factor.

There are a number of papers that consider the nature of players' emotional experience in relation to engagement in gameplay, using different lenses; these examine the role of predominantly pleasurable emotional experiences as a result of engagement, through both subjective and objective studies. These could perhaps be best understood as being a means of looking at the benefits or drawbacks of engagement. For instance, Merhi (2016) makes explicit the link between enjoyment of online games and player intention to play, suggesting that players who enjoy a game are more likely to be motivated to play it again. Jennett et al. (2008) explore the impact of engagement on players' emotional states, using both subjective and objective measures. They demonstrate how engagement can lead to both positive and negative emotions, including anxiety and uneasiness. Przybylski et al. (2010) consider the effect of engagement in gameplay on player wellbeing, using a 'self-determination theory' model to consider how video gaming contexts impact on psychological needs, including competence, autonomy, relatedness and mastery of control. They suggest that the emotional outcomes of video game play sit within a "wider constellation of experiences, relationships, and behaviours". (p. 164). As such, regardless of the type of game or the nature of engagement, the impact of engagement on the individual player could be said to be highly personal.

4.6.2.3. Gamification

Gamification is a topic investigated in all the perspectives considered in this review. However, since the primary aim of gamification is enhancing motivation and engagement for its users, it is especially important to examine the studies on its psychological effects.

Although Sailer, Hense, Mayr, & Mandl (2017) examination of the motivational aspects of gamification involve a simulated study of order-picking, rather than a real-world application, this recent work provides a helpful, theoretical starting point as an overview of gamification from the psychological perspective. Whilst the authors suggest that gamification is often considered in the literature as a generic or uniform construct, they advocate for a more focused, atomised approach to research that involves specific examination of different game design aspects, in order to consider

their relative affordances. As such, they suggest the game design elements that constitute gamification can include: points (to chart progress); badges (to mark accomplishment or achievement); leader boards (to rank players and promote competition); performance graphs (to enable a participant to chart and compare their own performance over time); meaningful stories (as a means of providing narrative context for an activity); avatars (as a visual representation of a player as part of a community) and teammates (embodied or virtual, to promote "conflict, competition or cooperation" (p. 374)). They suggest that each of these game design elements can relate to a particular need, and use 'psychological need satisfaction theory' (p. 374) to evaluate the effectiveness of the aspects of gamification against the perceived human need for competence, autonomy and social relatedness.

There is some research from the psychological perspective that indeed focuses on individual game design elements in more detail, such as the use of badges (Hamari, 2017; Sitra, Katsigiannakis, Karagiannidis, & Mavropoulou, 2017). Other recent literature explores gamification techniques generally, more broadly applied or focusing on multiple gamified elements, in a number of different contexts: in business and industry (Robson, Plangger, Kietzmann, McCarthy, & Pitt, 2016) health and physical therapy (Janssen et al., 2017; Koivisto & Hamari, 2014; Lister, West, Cannon, Sax, & Brodegard, 2014); and classrooms or educational contexts (Attali & Arieli-Attali, 2015; Stansbury & Earnest, 2017). There is also work that more generally looks at the potential of this approach (Sailer et al., 2017; Seaborn & Fels, 2015).

Badges are considered to be the most extensively researched of all the individual gamification elements (Hamari, 2017). Studies that have examined the effectiveness of badges, in educational and commerce settings, report both positive and negative outcomes (Hamari, 2017; Sitra et al., 2017). Hamari, (2017) reports on their own longitudinal study of badges as part of an online 'utilitarian trading service', finding that badges provided motivation for customers to use some, but not all, aspects of the service. Sitra et al. (2017) focus on badges used by students with special educational needs engaging with an e-learning platform. They reported positive outcomes in terms of student engagement, noting however that the success of the badges may also have been dependent on an accompanying narrative aspect of the e-platform. Both of these studies support Hamari's (2017) suggestion that the success of the intervention is often

dependent on the individuals involved and the task to which the badge is related, and therefore more research is needed in specific contexts to expand our understanding of this aspect of gamification.

In a study that examines gamification in the context of business, Robson et al. (2016) describe a number of gamified experiences involving customers and employees. Noting the conflict between managers' and scholars' interest in gamification in this context, compared to the relative 'dearth' of research (p. 36), they also conclude that in instances where gamification approaches were unsuccessful this largely stemmed from a mismatching of mechanic-participants-intended outcome. The assumption here seems to be that gamification is likely to generate positive outcomes, if you do it correctly. Perhaps most significantly, Robson et al. (2016) also consider the ethical aspect of gamification, notably absent from the rest of the literature, particularly in relation to employee consent to enter into gamified experience. This dimension of gamification is examined further in Section 4.3 Ethical Perspective.

Lister et al. (2014) conducted a comprehensive review of the gamification features present in health and exercise apps, focusing on those available in the Apple app store. They found an abundant use of gamification elements across these apps, whilst noting that there was no coherent pattern or industry standard application of gamification techniques in these examples. Clearly, the prevalence of gamification techniques reflects an industry-wide interest in using such techniques, and its ongoing and widespread adoption also suggests that these are popular with consumers. Nevertheless, whilst this review is useful for surveying the field in terms of availability of gamified opportunities in relation to health, it does little to explain how effective gamification techniques are in relation to health provision. Janssen et al. (2017) suggest that a closer relationship between game designers and medical professionals would help to improve opportunities for gamification (and game based treatments) in relation to physical therapy. Whilst they provide some potential ways in which principles of gamification could be incorporated into therapy sessions, these are based on the assumption that such approaches are effective.

González et al. (2016) offer a study that examines the use of a gamified training programme to prevent childhood obesity. Here, they offered a number of activities rolled out in homes and schools, designed to promote healthy choices and physical

activity. However, the term gamification here was used partially to describe the unification of three game related interventions which could perhaps be categorised here as serious gaming and exergaming. Gamification techniques were nevertheless employed in relation to the training program, including: points, badges and leader boards, time, challenges and positive feedback. Whilst a generally positive conclusion was reached with regards to the gamification strand of the project in terms of compliance with planned activities, for the purposes of understanding the relevance of each gamified technique a more nuanced analysis of findings would be required. Koivisto & Hamari (2014) examined the use of gamification in relation to exercise. They caution that the effectiveness of the gamified approach appeared to reduce over time, suggesting that more work needs to be completed in order to understand how to maintain initial gains made through gamified interventions. Considering these examples, and the absence of other evidence in the area of health, it is possible to conclude that research around gamification and its uses in health contexts is clearly still in the early stages, albeit with some focus on the related area of exergaming providing some crossover here.

In terms of recent literature relating to education and gamification, Attali & Arieli-Attali (2015) explore whether a particular approach to gamification could affect test scores, with points being rewarded for accuracy and speed of response. The study examined the responses of both children and adults, finding a relative lack of impact of the approach, both in terms of achievement and 'likeability' of the test. This led them to surmise that such 'bells-and-whistles' (p. 63) may not always be successful. Stansbury & Earnest (2017) examined the impact of using 'meaningful gamification elements' on students' learning in an organisation psychology course over a year. This experimental study examined the impact of game design elements including role play, points, narrative context, teamwork and challenge. It found that the students reported higher levels of motivation and enjoyment on the gamified version of the course, with students reacting positively to questions on the role play and teamwork aspects. However, the study acknowledges that we still know little about effects of this type of gamification in terms of long term learning or knowledge retention.

Whilst the studies considered above take a generally positive approach to gamification, Seaborn & Fels (2015) acknowledge that it is an approach that does not

escape criticism elsewhere. They note that the 'stock' approach to gamification, namely adopting a points based approach, is considered by some game designers as a fundamental misunderstanding of the complexity of the game mechanics from which gamification purports to draw its principles. However, they also acknowledge that this understanding of gamification techniques is in itself also something of a simplification, citing 'social factors such as self-efficacy, community and peer approval' (p. 18) as some of the benefits that participants can draw from even some of the most stripped-down gamified contexts.

As Hamari, Koivisto, & Sarsa (2014) noted, "gamification as an academic study is relatively young and there are relatively few well-established theoretical frameworks or unified discourses" (p. 3030). On the evidence of the literature reviewed here, whilst there have been some insights produced in recent years, the majority of studies have been small in scale and scope, hinting at a potential that future work should seek to harness and critique. Much work still remains to help us understand the impact and value of gamification, and its multiple, complex components.

4.6.2.4. Addiction

The potential of games for engagement and immersion can sometimes be problematic: some individuals seem to develop addiction to gaming, pursuing this behaviour to the detriment of social, work and school life. The study of games' addictive potential is one of the main branches of psychological research on the effect of games. In part, this interest has been sparked by the American Psychiatric Association's inclusion in 2013 of the Internet Gaming Disorder (IGD) among the "Conditions for Further Study" in Section 3 of the Diagnostic and Statistical Manual of Mental Disorders 5 (DSM-5; American Psychiatric Association, 2013). This decision was based on an already considerable corpus of literature, comprising more than 250 publications (Petry et al., 2014), although some of these studies considered all kinds of internet use (including social networking, web surfing, etc.) and all kinds of gaming (including offline gaming). Prevalence rate for IGD varies from study to study, and is estimated to be between 1.7 and 8.5% among adolescents (Gentile, 2009; King, Delfabbro, Zwaans, & Kaptsis, 2013; Rehbein, Psych, Kleimann, Mediasci, & Mößle, 2010)

The APA's IGD definition is provisional, and the APA task force recommended further research on the criteria themselves, in order to evaluate their representativeness,

completeness, and appropriateness of wording. The task force also expressed the need for the development of psychometrically validated tests for IGD- a need that was met shortly thereafter by the IGD-20 (Pontes, Király, Demetrovics, & Griffiths, 2014), the IGDS-SF9 (Pontes & Griffiths, 2015), and the IGDT-10 (Király et al., 2017).

The DSM-5 definition generated some controversy, as IGD is considered a behavioural addiction akin to gambling and - aside from the absence of a physical substance – also to other addictions. As a result, criteria for diagnosis comprise withdrawal and tolerance, symptoms characteristic of substance abuse behaviours. This parallelism was an explicit aim of the APA task force (Petry et al., 2014) and was criticized even before its actual implementation (Christopher J. Ferguson, Coulson, & Barnett, 2011). Specifically, some authors argue that the defined criteria may pathologise normal gaming behaviour (Billieux et al., 2015), that withdrawal symptomatology has no clear evidence of association with problematic gaming (Kaptsis, King, Delfabbro, & Gradisar, 2016; Snodgrass et al., 2017), and that the tolerance criterion is not applicable at all in the gaming context (Kardefelt-Winther, 2015). Furthermore, the IGDT-10 validation study - while not criticizing APA's criteria as strongly - reports concerns for the validity of the "preoccupation" and "escape" criteria (evaluating, respectively, the amount of time spent thinking about gaming when not playing, and the use of games to forget personal problems or relieve uncomfortable feelings; Király et al., 2017). On the other hand, neuroimaging studies do seem to support the parallelism between pathological gaming and substance abuse (Kuss, 2013; Weinstein & Lejoyeux, 2015), and the criteria have been met favourably by other research groups (e.g. Bargeron & Hormes, 2017; Kim et al., 2016; Pawlikowski & Brand, 2011).

Despite the controversy, the proposed definition of IGD has been widely adopted by researchers, and post-2013 studies on problematic gaming behaviour generally use the DSM-5 criteria for diagnosis. This has led to a series of studies which identify potential risk factors for IGD as described in the DSM-5, such as: adolescence (Andreassen et al., 2016; King & Delfabbro, 2016; Kuss & Griffiths, 2012; van Rooij et al., 2014); male gender (Andreassen et al., 2016; Strittmatter et al., 2015; van Rooij et al., 2014); low social competence and/or loneliness (Andreassen et al., 2016; Gentile et al., 2011; van Rooij et al., 2014); high impulsivity (Billieux et al., 2015; Gentile et al.,

2011; Yen et al., 2017); low self-esteem (Billieux et al., 2015; van Rooij et al., 2014); high neuroticism, low conscientiousness and/or low extraversion (Müller, Beutel, Egloff, & Wölfling, 2014), and the meaning attributed to gaming in an individual's sociocultural context (Kuss, 2013). Additionally, there is a fair amount of evidence for IGD comorbidities with depression (Andreassen et al., 2016; Gentile et al., 2011; van Rooij, Schoenmakers, & van de Mheen, 2017), anxiety (Gentile et al., 2011; van Rooij et al., 2017), Attention Deficit and Hyperactivity Disorder (Andreassen et al., 2016; van Rooij et al., 2014; Yen et al., 2017), Obsessive-Compulsive Disorder (Andreassen et al., 2016), substance abuse (van Rooij et al., 2014), and social phobia (Gentile et al., 2011; van Rooij et al., 2014).

Regarding potential treatments, Dong & Potenza (2014) theoretical paper offers a cognitive-behavioural model of IGD that considers three components (motivational drives for reward-seeking and stress reduction, executive inhibition, decision making weighing short- and long-term consequences of gaming behaviour). On the basis of their model, the authors suggest potential treatments, such as mindfulness-based stress reduction, cognitive bias modification, cognitive enhancement therapy, and Cognitive-Behavioural Therapy (CBT). King & Delfabbro (2016) propose a different theoretical model, in which gaming addiction is based on four cognitive maladaptive beliefs: beliefs about game rewards value and tangibility; maladaptive rules about gaming behaviour; over-reliance on gaming to meet self-esteem needs; gaming as a method to gain social acceptance. Their model, while conceptually different from Dong & Potenza's (2014), also leads to the use of CBT. Additionally, (Weinstein & Lejoyeux, 2015), on the basis of IGD similarity to substance addictions, suggest the development of pharmacological treatments.

Indeed, there is evidence for the effectiveness of both mindfulness training (Yao et al., 2017) and CBT (K. S. Young, 2013). However, King & Delfabbro (2014a, 2014b) report that research on IGD treatments is still inadequate, and there is not enough evidence for long-term benefits of CBT.

Intensive camps for addiction treatment, which have been successfully conducted in South Korea and Japan, can be used for combining several treatment techniques, maximizing their potential effectiveness (Sakuma et al., 2017).

4.6.2.5. Perceptual and cognitive impact

Another major area of interest in psychology in relation to games is the study of the effect of playing specific types of video game, usually entertainment games, on perceptual and cognitive skills. Given that these games are not usually developed with specific training purposes in mind, but for entertainment purposes only, studies tend to focus on identifying their potentially unintended effects.

A frequent claim is that video game players (VGPs) outperform non video game players (NVGPs) on a wide range of cognitive abilities and perceptual tasks, for example spatial distribution of visuospatial attention (Green & Bavelier, 2003), visual attention (Vallett, Lamb, & Annetta, 2013), the ability of switching flexibly between tasks (Colzato, 2010) and perform multiple simultaneous tasks (Strobach, Frensch, & Schubert, 2012). Most of these studies examine the effects of 'action' video games, defined by Green & Bavelier (2003) as those that have fast motion, require vigilant monitoring of the visual periphery and often require simultaneous tracking of multiple targets (p. 3). However, Boot, Blakely, & Simons (2011) highlight some pitfalls that different studies have in common which might cause us to question some of the conclusions. For instance, they identify overt recruitment of participants, similarity between the experimental tasks and the game played, and the potential for a placebo effect. Another issue raised by Kristjánsson (2013) is the direction of causality. For instance, it is unclear whether people develop superior cognitive skills because of gaming, or whether people with superior skills are more likely to become gamers.

Given this, there are several questions raised in this field:

- Is there an effect of video game playing on cognitive and perceptual skills?
- How might this transfer work: is it general or task specific?
- Is the transfer particular to action video games or does it also exist for other types of game?

In the corpus of papers considered, a panorama of these issues is sketched in three non-systematic literature reviews (Bavelier, Green, Pouget, & Schrater, 2012; Boyle, Connolly, & Hainey, 2011; Green, Pouget, & Bavelier, 2010), one systematic, but not specifically focused review (Boyle et al., 2016), and one meta-analysis (Powers,

Brooks, Aldrich, Palladino, & Alfieri, 2013). A number of claims are made across these papers.

For instance, Boyle et al. (2011) claim that there is a solid evidence base suggesting visual-perceptual advantages in playing games, while the potential for improving other cognitive dimensions appears weak. (Green & Bavelier, 2012), meanwhile, focused their review on studies of attention control and action video games, stating that the positive effect of action video games is greatest in tasks in which performance is limited by top down attention, or the processes that control and regulate attentional allocation and resource management.

(Bavelier et al., 2012) present a number of demonstrated benefits of playing action video games in different cognitive domains, such as vision, cognitive functions, decision making and attention. They then hypothesize a more general effect of action video games in fostering a capability they define as “learning to learn” (p.392). In particular, they conclude that video game players develop the ability to exploit task-relevant information more efficiently, and that active video games would enhance a general capacity to control top down attention and learning of a new task. According to the authors, this conclusion accounts for the wide range of skills enhanced in video game players. However, Oei & Patterson (2014) raise doubts about this claim.

The meta-analysis by Powers et al. (2013) provides an important contribution to the literature in this field. The authors separately analysed 72 quasi-experimental studies and 46 true experiments, with the intention of exploring the available research on cognitive gains of gameplay. They also hoped to resolve the debate between general *vs.* specific task impact. The authors highlighted some issues regarding the design of the considered studies, suggesting that there may have been some overt recruitment in quasi-experimental studies. They also considered several moderating factors potentially affecting the results, including game-related conditions, participant-related conditions, possible bias, and publication bias. The authors calculated the effect size for the overall effects on information processing and several moderators: information processing domain (auditory, visual, spatial imagery, motor skills and executive functioning), type

of game (action/violent, mimetic[10], Non action[11] and puzzle games), type of control group, age, gender, public action type and research group. According to this study, video game play is consistently and significantly associated with enhancements in information processing skills. Nevertheless, the effect is not homogeneous among the domains or in the two kinds of studies (quasi experimental and true experiments). Considering the quasi-experimental studies, the effect is more consistent with regard to the visual and auditory processing dimensions, whilst in the true-experimental studies motor skills seem to be the aspects most affected. Especially in true-experiments, the domain of executive functions (dual/multitasking, inhibition, intelligence, task switching and working/short-term memory) seems to be less affected, while the effect is larger in quasi-experimental studies. In order to explain this discrepancy, the authors suggest the existence of Hawthorne effects in the latter studies. Following these results, the authors conclude:

> *"The meta-analysis of true experiments provided evidence that game training can enhance specific perceptual and motor skills, including visual and spatial processing and hand-eye coordination. However, the results failed to support the stronger claim that video games make people smarter (Hurley, 2012; Zichermann, 2011), as true experiments failed to show positive gains for multiple aspects of executive functioning, such as multitasking, nonverbal intelligence, task switching, and working memory" (Powers et al., 2013, p. 1074).*

In terms of moderating factors, the meta-analysis shows that the type of game used can influence outcomes, both in quasi-experimental studies and in true-experiments: action video-games, which appear to be the most commonly studied in the literature (see Bavelier et al., 2012), proved to be less effective than mimetic games in quasi-experimental studies and than any other type of video game in true-experiments. The authors conclude:

> *"While these results suggest a pattern consistent with claims that action game*

10 Mimetic games: games in which the player mimics the action on the screen, including *Wii* games

11 Non action games: educational, sports and simulation games like *the Sims 2*.

> *play may be more beneficial for inducing changes in information processing than are other types of video-game play (Bavelier et al., 2012), one cannot claim causality—that game play enhances skills—as it may be that people who play action/violent games may be drawn to them because of pre-existing abilities." (Powers et al., 2013, p. 1071)*

It is evident that, in experiments, researchers typically select specific games for training, having deemed the features relevant for the information processing in the domain of study. Therefore, more work needs to be performed in order to compare the effects of different games within a single information processing domain. In terms of other moderating factors, the *type of control group* proved to moderate quasi-experimental studies but not true-experiments, and the same holds for the *Gender* moderator. *Age* and *publication type* were considered to be factors that moderated effects both in quasi-experimental studies and true experiments. Lastly, the authors identified a moderating effect of the research group in quasi-experimental studies and not in true experiments, hypothesizing the Hawthorne effect.

Following this meta-analysis, the relationship between gaming and cognition remained the focus of active debate as researchers continued to conduct studies in an attempt to resolve these contradictory findings. In our corpus, in the last years the issue was dealt by Boyle et al. (2016), in a systematic literature review, and in some papers focusing on specific skills; these last have, clearly, a more limited impact on our overall conclusions.

Boyle et al. (2016) conclude that the 21 studies (5 RCTs, 12 quasi experimental and 2 qualitative research) analysed provide additional evidence to support benefits of playing action video games at attentional and visual perceptual level.

With regard to the effect of gaming at perceptual level, van Ravenzwaaij, Boekel, Forstmann, Ratcliff, & Wagenmakers (2014) contrast with previous findings of Green et al. (2010). Van Ravenzwaaij et al. (2014) carried out two experiments with non video game players (NVGPs) but failed to find any performance benefit for participants who played an action video game compared with participants who played a cognitive game, or no game at all. These findings are partially consistent with the outcomes of the Powers et al. (2013) meta-analysis, where the authors concluded that in true-

experiments, action/violent video game training is not more effective than training with other games. They also conclude that there is a reliable transfer effect of gaming in general.

Regarding executive functions, which describe a wide set of cognitive processes, Moisala et al. (2017) explore the relationship between self-reported daily gaming activity, working memory (n-back) task performance and related brain activity measured using functional magnetic resonance imaging (fMRI). The authors conclude that a greater degree of daily gaming experience is associated with better working memory functioning and task difficulty dependent modulation in fronto-parietal brain activity; however they don't affirm any direction of causality.

Another issue raised by Powers et al. (2013) is the role of video game genres in training different cognitive aspects. In the study by Oei & Patterson (2013), groups of non-gamers performed four behavioural tasks before and after video game training with different kinds of games (action, spatial memory, match-3, hidden-object, and an agent-based life simulation). The authors concluded that video game-related cognitive improvements may not be due to the training of general broad cognitive systems but instead to frequent utilization of specific cognitive processes during game play. Nevertheless, the results were consistent with the previous study of Green & Bavelier (2012), showing that action video games led to the most varied transfer. Hence, it is also plausible that action-video games trained high-level general processes like attention or learning mechanisms.

Dobrowolski, Hanusz, Sobczyk, Skorko, & Wiatrow (2015) analyse the differences between two video games genre: first person shooters (FPS) and real-time strategy games (RTS). The authors conclude that cognitive abilities may be differentially enhanced depending on the genre of video game being played. Their findings tend to align with ‘‘common demands’’[12] theory (Oei & Patterson, 2014), while Bavelier et al.'s (2012) ‘‘learning to learn’’ framework does not account for the selective performance advantage.

12 “Common demands” theory proposes that transfer effects are specific to common demands shared between the video game used and the transfer task.

Considering these publications, it is evident that the issue of the transfer effect of gaming (and whether it is general or specific) still remains open.

Different authors (Kristjánsson, 2013; Oei & Patterson, 2014; Powers et al., 2013) call for a refining of research methodology in the field and advocate carrying out longitudinal studies to analyse the durability of transfer effects. Such studies could help to provide conclusive answers. In the corpus analysed, no longitudinal studies are available, perhaps exposing a weakness in this aspect of the research. Oei & Patterson (2014) also question the link between the effects highlighted in specific tasks and real world activities. None of the papers of the core corpus addresses this issue; of course, this could be due to the selection criteria (keywords used and/or the citations threshold.) Exploring the transfer from video game training to the workplace or to rehabilitation would surely be a worthwhile endeavour.

4.6.2.6. Training in older adults

As the percentage of older people within the wider population has increased in recent decades (United Nations Population Division, 2002), this area of research is of increasing interest from a healthcare perspective. Besides the effect of normal aging, older people can suffer physical and cognitive impairments that have an impact on their quality of life. This includes neurological diseases (Alzheimer's disease, Parkinson disease) and other physical pathologies (diabetes, hypertension, etc.).

It is suggested that cognitive training[13] could be effective in improving cognitive performance in older adults (Martin, Clare, Altgassen, Cameron, & Zehnder, 2011) and there is growing interest in using computerized training in general - and digital games specifically - for this purpose as such tools offer a number of advantages (Kueider, Parisi, Gross, & Rebok, 2012).

The issue of the effectiveness of digital game training for older adults is intertwined with their effectiveness in general at cognitive and perceptual level (see above). With this in mind, empirical research in the field provides inconsistent results

13 Cognitive training can be defined as an intervention that provides structured practice on tasks relevant to different aspects of cognitive functioning such as memory, attention, language or executive functions.

regarding the effectiveness of gaming in improving older adults' physical and cognitive functions, making it difficult to reach a definitive conclusion.

In the corpus of papers considered here, both the physical and the cognitive effect are explored in three literature reviews (Bleakley et al., 2013; Kueider et al., 2012; Miller et al., 2014) and two meta-analyses (Toril, Reales, & Ballesteros, 2014; Zhang & Kaufman, 2016). Here, authors are unable to reach a definitive conclusion regarding video game effectiveness in the dimension(s) considered (physical and/or cognitive) in older adults. Where studies involving physically or cognitive impairment were included in the analysis, no significant differences between the two groups have been found.

Each of the three literature reviews presents some limitations in terms of their relevance to our study. The studies of Kueider et al. (2012) and Bleakley et al. (2013) dealt only tangentially with video games. In the case of Bleakley et al.'s (2013) study, this is coupled with other identified methodological limitations, meaning that the results of this review are also of limited scope. Miller et al. (2014) rated the quality of the considered studies low (pilot or feasibility studies), suggesting that evidence was not strong enough to conclude that interventions were effective.

The two meta-analyses provided more solid and sound findings. Toril et al. (2014) focus on the cognitive dimension, building on the review by Kueider et al. (2012). This included studies involving only healthy adults with pre-post evaluation. They analysed 20 studies using a range of video games including entertainment games (e.g. *Medal of Honor, Tetris, Donkey Kong*) and packages addressing classic cognitive tasks (Nintendo Brain Training, etc.). The meta-analysis confirmed that training older adults with video games improves cognition. As to the "transfer effect" (discussed in Section 4.6.2.5 Perceptual and Cognitive Effects) the study showed an effect in the cognitive functions explored, excluding executive functions, which did not show a significant effect. These results are congruent with the findings of Powers et al. (2013) discussed in the perceptual/cognitive effects section. Among the different cognitive functions, attention and speed processing appear to gain most. Moreover, age and duration of the training appeared to have moderating effects. Somewhat surprisingly, training over short periods of time seemed to be more effective than that over a longer duration; the benefits of training were greatest in the oldest participants.

Zhang & Kaufman's (2016) meta-analysis took into account studies addressing both healthy participants and those with cognitive and physical impairments, and both physical and cognitive domains. This was considered a point of interest by the authors since digital games have been used in older adult rehabilitation since the mid-1980s. They found significant effect sizes for all the categories, including executive functions; this last finding was in contrast with the meta-analysis by Toril et al. (2014). Significantly, both healthy and impaired participants seem to benefit from digital game training. In terms of moderators, in Physical balance no significant effects were found, while for speed processing the effect of living setting was significant. The authors were also interested in identifying possible relationships between the age of participants or time of game intervention with the dimension of the effect. In contrast with Toril et al. (2014), however, the results were inconclusive.

While in both of these meta-analyses entertainment games were the mostly used game type, other studies focus specifically on the effectiveness of serious games (SG). Wiemeyer & Kliem (2012) conducted a non-systematic review exploring the real advantages of using SG in rehabilitation with elderly people. According to the authors, studies on the impact of SG and VR on different diseases vary greatly in terms of both design and results. In general, they show promising tendencies for additional benefits of SG and VR at the physiological, behavioural and psychological level. However, the authors argue that many studies suffer from poor quality.

Despite the conclusions of the meta-analyses, the transfer effect of video games on cognitive functions in older adults deserves to be further explored. According to Toril et al. (2014), an approach based on neuroimaging could help to identify the mental processes operating in multiple task domains. These processes should be targeted with a cognitive task, with the game and assessed with another related task.

A common issue raised across the studies is the effect of training in everyday life (Toril et al., 2014; Zhang & Kaufman, 2016). While participants seem to gain advantages at both cognitive and physical levels, the impact on everyday tasks is rarely investigated. Similarly, investigation of the long-term effects of training is limited. For instance, Anguera et al. (2013) found performance benefits after multitasking training with a custom designed 3D video game. These benefits were seen to extend to untrained cognitive control abilities and to last six months after training. By contrast, long term

advantages were assessed through the game itself. Since the usefulness and effectiveness of a particular model of training are ultimately linked to its impact in everyday life, further research is needed in relation to long-term, everyday impact.

It may also be important to consider the difficulty that healthy or impaired elderly people can have in handling video games designed for a quite different target audience (Robert et al., 2014). A number of authors claim that (more) games should be developed specifically for this population, with appropriate content, interface and controls (Robert et al., 2014; Toril et al., 2014; Wiemeyer & Kliem, 2012). This is an area of potential interdisciplinary collaboration.

4.6.2.7. Impact on health

The impact of video games on physical health has been widely studied, with many high quality contributions emerging. While this field of research doesn't necessarily adopt a strictly psychological perspective, there are many connections with psycho-physiological wellbeing that make it worth considering here.

We can broadly classify video games as either sedentary (most video games) or active, i.e. video games that require considerable body movement during play. Examples of the latter category, sometimes labelled 'exergaming', include *Wii Sports*, *Dance Dance Revolution*, and *Sony EyeToy: Play.*

Research on traditional video games has investigated the potentially detrimental effects of the increasingly sedentary lifestyle stemming from habitual video game playing. In these studies, video gaming time was typically considered an indicator of sedentarity among other activities, such as TV viewing, Internet surfing, or reading (see, e.g., Costigan, Barnett, Plotnikoff, & Lubans, 2013; Mushtaq et al., 2011; Rezende, Rodrigues Lopes, Rey-López, Matsudo, & Luiz, 2014). Overall, habitual sedentary behaviour was found to be associated with obesity, high blood pressure, high total cholesterol, physical unfitness, cardiovascular disease, type 2 diabetes, metabolic syndrome, and ovarian, colon, and endometrial cancer (Rezende et al., 2014). These health effects are not exclusively associated with video game use, although risk for type 2 diabetes and colon cancer is associated specifically with screen time and not overall sedentary behaviour (Rezende et al., 2014).

On the other hand, exergaming has been studied for its potential beneficial effects on physical health in both healthy individuals (see, e.g., Bleakley et al., 2013; Staiano & Calvert, 2011) and individuals with specific diseases and impairments (e.g. Barry, Galna, & Rochester, 2014; Lotan, Yalon-Chamovitz, & Weiss, 2010; Verheijden Klompstra, Jaarsma, & Strömberg, 2014). Results emerging from reviews and meta-analyses generally support the hypothesis that exergames can improve physical activity and health, but the low quality of the studies is often reported as a major limitation (e.g. see above for Miller et al.'s 2014 systematic review). A recommendation to improve the quality of research is also expressed by Barry et al., (2014), Bleakley et al. (2013), and Verheijden Klompstra et al. (2014). Interestingly, the only Randomized Controlled Trial in Barry et al.'s (2014) systematic review is also the single study that didn't find incremental effectiveness for exergames when compared with traditional training - justifying the concern that the overall low quality of studies on exergaming may have inflated the results.

Lastly, gamified systems seem to have the potential to encourage individuals to engage in physical exercise (Chen & Pu, 2014). However, their long term effectiveness is still under-investigated and there is preliminary evidence of a decline in engagement with repeated use (Koivisto & Hamari, 2014). The impact of this type of intervention on health is explored in more detail later on in the next section.

4.6.3. Recommendations

Psychological research on the effects of games covered in this literature review has explored several topics extensively, reporting a solid body of evidence on several phenomena. This is borne out by the sheer number of large-scale studies, reviews and meta-analyses on the topics of Internet gaming addiction or the cognitive benefits of gaming in older adults. Despite this, recommendation-focused papers are practically non-existent and the few recommendations presented in empirical papers are usually addressed to researchers.

Recommendations to researchers usually detail areas for further investigation and methodological issues that should be taken into account in future research, with a clear focus on the generalizability of results and the feasibility of adopting gaming on a large scale for specific purposes.

For example, in their systematic review of papers on cognitive training of older adults, Kueider et al. (2012) conclude that "More well-designed randomized controlled trials with larger samples sizes are necessary to confirm these results. Computerized training may be a lonely individual activity and long-term adherence to such programs may be quite limited. Future studies should investigate this aspect of computer training. Furthermore, future studies should examine the efficacy and feasibility of web-based programs geared towards older adults." Similarly, Verheijden Klompstra et al.'s (2014) review on exergaming in elderly people with a history of heart failure reports that "further research, with a higher level of methodological quality and that examines the relative efficacy and costs of intervention programs aimed to enhance daily activity in non-healthcare settings, such as home settings, is needed. Also, a longer follow up period is needed to examine the long-term effects of these promising exergame platforms". Relatedly, Nouchi et al. (2012) recommend investigating the generalizability of improvements on brain training tasks to real world tasks.

Other reviews, instead, advocate greater research depth, rather than breadth; for example, Boyle et al.'s (2011) review on the role of psychology in research on games concludes that "Psychologists should work in close collaboration with researchers in other disciplines in systematising and understanding computer games to overcome the fragmentation (work on characteristics of games, characteristics of the players, game application)". Ewoldsen et al.'s (2012) study on the effect of playing violent video games cooperatively or competitively suggests that "video game research needs to consider not only the content of the game but also how video game players are playing the game".

A second broad category of recommendations pertains to internet gaming addiction - and addictive behaviour in general - and is directed to both healthcare professionals and policy makers. As detailed above, academic research is very active in finding the risk and protective factors for gaming addiction. This translates to recommendations, either explicit or implicit, to healthcare workers (who can now better understand what kind of socio-psychological context facilitates the development of addiction) and policy makers (as the discovery of risk factors can inform prevention policies and projects). For example, Kuss et al. (2012) report that young people are particularly at risk of addiction and should therefore be targeted specifically by

prevention programs. On the other hand, Meng, Deng, Wang, Guo, & Li (2015) suggest to extend research on populations beyond the 'typical' IGD patient (i.e. young, white, and male) in order to better understand the characteristics of the disorder. The same authors also recommend an increase in twin and genetic studies of IGD. Fauth-Bühler & Mann (2017), similarly, suggest to further investigate the neurobiological basis of IGD. In a different vein, Kaptsis, King, Delfabbro, & Gradisar (2016) suggest to run more qualitative studies and to engage with the gaming community to better understand the difference between non-pathological and pathological gaming. Additionally, research on IGD nosology (D. J. Kuss & Griffiths, 2012), measures (Christopher J. Ferguson et al., 2011), and potential treatment (King & Delfabbro, 2014b; D. J. Kuss & Griffiths, 2012; Weinstein & Lejoyeux, 2015), will, too, inform the American Psychiatric Association on how to revise IGD criteria for diagnosis. Lastly, Bavelier, et al. (2012) report that "studies of internet-game play are currently somewhat polarized and this area of research is likely to be improved if investigators acknowledged both the potential beneficial and harmful effects of video games".

Recommendations to stakeholders other than researchers, healthcare professionals, and policy makers are infrequent. These include recommendations to (a) city planners (Xu et al.'s (2012) review suggests city planners should invest in parks, sport clubs, community centres, and other spaces that adolescents can use to have face-to-face interactions, in order to reduce the risk of addiction presented by having only games as a mean of interaction) (Xu et al., 2012); (b) parents (the same review recommends parents should monitor and control their children's computer usage), (c) teachers (who are in the position to detect potentially addicted children and adolescents), and (d) developers.

Regarding this last group, some recommendations follow from the identification of the benefits of games (e.g. for attentional training; see Mishra, Zinni, Bavelier, & Hillyard, 2011), and suggest that efforts in developing applied games for the improvement of cognitive skills and/or health should be increased. Oei & Patterson (2013), especially, advocate the development of a full battery of games to be used for the training of cognitive and perceptual skills - a battery large enough to cater to all kinds of preferred game styles (e.g., also including non-action games; see also Boyle et al., 2012a, and Green & Bavelier, 2012). However, applied games for clinical

populations should first establish that they are safe and that their use is feasible for rehabilitation (Barry et al., 2014). This recommendation for safety evaluation can be applied to all games destined for older adults, and those games should also be optimized to engage this peculiar population (Bleakley et al., 2013).

Another recommendation (Xu et al., 2012), perhaps directed towards the game publishing and marketing sector as a whole, is to increase accessibility of online games from mobile and to promote social interaction between gamers, with the caveat that these improvements can increase the addictive potential of games.

Lastly, the one study we found whose explicit aim was to develop recommendations deserves particular attention. This is a mixed-method study by Robert et al. (2014) focusing on the development of serious games for people with Alzheimer's disease, related disorders, and frailty. While focusing on a very specific population, some of the recommendations found could, in theory, be extended to applied games in general. For example, the recommendation to develop comprehensive cost/benefit analyses is useful for the development of all applied games, as is the recommendation to invest more in usability testing (as a more usable software lessens cognitive effort and has fewer side-effects such as cybersickness).

On the other hand, some recommendations clearly pertain to a clinical setting, such as the recommendation that serious games should be adopted only after a standard clinical assessment of the patient's deficit. Another is that improvements should be measured using the same methods used for clinical assessment and that therapists should be directly involved in the assessment phase.

Among the more general issues identified by the authors, some are ethical in nature (e.g. privacy concerns), and will be further explored in Section 4.7 Ethical Perspective. Others, however, pertain more to the psychological aspects of serious games. In this case, recommendations that implicitly emerge from the considered studies are: the difficulty of the game should be adapted or adaptable in order to find the optimal challenge level for learning; similarly, an optimal number of steps for each challenge should be found, so that the user feels challenged but not overloaded; the player should be kept in the "flow zone" in order to maximize motivation and engagement; naturalistic interactions should be promoted to facilitate usage of the

games in a home environment; users should be engaged through both sensory and motor modalities; possible impairments should be taken into account (e.g. hearing problems); the social and cultural background of the user should be considered to promote engagement.

Lastly, in the same vein of Bavelier et al. (2011), who suggest that organizations should objectively quantify the positive and negative consequences of playing specific video-games, the authors stress the importance of creating official guidelines for the development of serious games in order to ensure their safety, usefulness, and ethicality.

4.6.4. Conclusive Remarks

The present review identified several strong points, as well as some weaknesses, of research on video games and gamification from the psychological perspective. Specifically, the core of contributions we considered included, for some topics, multiple meta-analyses referencing high-quality papers. The topics of addiction, cognitive benefit, and engagement receive considerable attention on the part of researchers. Although consensus on some key issues – such as the exact nature of Internet gaming disorder, or the extent of generalizability of cognitive benefits of gaming – has not yet been reached, the debate is lively and evidence-based. In other fields, such as the exploration of the benefits of exergaming or the use of games for the rehabilitation of older adults, the overall quality of studies is reported to be low (Miller et al., 2014; Wiemeyer & Kliem, 2012), and authors recommend increased methodological rigor. Furthermore, some meta-analyses detected potential publication bias and systematic discrepancy of results between different research groups, even among 'high-quality' studies (see, e.g., Powers et al., 2013, for the benefits of gaming on information processing, and Greitemeyer & Mügge, 2014, for the effects on aggressive behaviour, better detailed in the ethical perspective section). This result is troubling, especially in the context of the so-called 'replication crisis' in psychology (Ioannidis, 2005; John, Loewenstein, & Prelec, 2012). Pre-registered studies could ameliorate the issue (Chambers, 2013), but the root of the discrepancies could be in the differences in sampling, measures, and analyses adopted by different research groups, and therefore could be harder to detect and solve.

A second issue emerging from our analysis pertains to the distance between academic researchers and other stakeholders. The vast majority of recommendations in the contributions we considered were directed to other researchers and, more rarely, to healthcare professional and policy makers. Recommendations to, and even consideration of, developers and users were strikingly rare. The point of view of gamers themselves was virtually absent from most contributions, even for those topics (e.g. engagement or addiction) for which it could have offered precious insights. This shortcoming runs the risk of making psychology contributions on the study of games self-referential and detached from stakeholder communities outside academia.

A factor compounding this sense of detachment from the objects of inquiry is that relatively few studies focus on specific game mechanics and/or player characteristics (e.g. Attali & Arieli-Attali, 2015; Kuss et al., 2012; Orji, Vassileva, & Mandryk, 2014). The vast majority of studies consider games as a whole (e.g. Mentzoni et al., 2011; van Rooij et al., 2014; Xu et al., 2012), or even considers games together with other internet, computer, or screen use (e.g. Fischer, Greitemeyer, Kastenmüller, Vogrincic, & Sauer, 2011; Lemola, Perkinson-Gloor, Brand, Dewald-Kaufmann, & Grob, 2015; Tandon et al., 2012). As a result, evidence on the effect of specific game mechanics is relatively scant and mostly concerns the divisions between action and non-action games or violent and non-violent games (two partially overlapping broad classifications). This research gap may be the result of two opposing tendencies. On the one hand, some studies consider the category of "games" as homogeneous, potentially diluting large effects among very diverse games. On the other hand, some studies focus on specific titles (e.g. *Portal 2*, *Lumosity* - Shute, Ventura, & Ke, 2015; *Halo 2* - Ewoldsen et al., 2012; *World of Warcraft* - Pawlikowski & Brand, 2011) without exploring whether or not the results could be extended to other games that use the same mechanics (e.g. mechanics emphasizing competitiveness or cooperation – see Liu, Li, & Santhanam, 2013; specific gamification mechanics, as studied by Sitra et al., 2017; or dynamic difficulty adjustment - see Liu, Agrawal, Sarkar, & Chen, 2009). This lack of evidence is further compounded by the lack of evidence on the effects of player characteristics (see Sourmelis et al., 2017), as the interplay between the two can lead to different effects (Colzato, 2010; Orji et al., 2014)(Colzato et al., 2013; Orji et al., 2014). Evidence on the impact of specific game mechanics and player characteristics on

motivation, cognitive benefits and potential adverse effects could be useful to tailor games towards specific populations and purposes, as advocated by Bleakley et al. (2013), Orji et al. (2014), or Zhang & Kaufman (2016).

4.7. Ethical Perspective

As games and gameful interactions of various kinds continue to permeate various spheres of society – entertainment, education, commerce, culture – attention is increasingly turning to the ethical implications of this phenomenon. Like books, films and other culturally-oriented media, digital games and gameful interactions encapsulate a particular view of society and what it means to be human, whether this is explicitly intended or not. As such, they necessarily entail an ethical dimension, both as cultural artefacts in themselves and as elements within a social communication process. The special characteristics of many digital games such as immersion, interactivity and player agency/decision making, heighten the potential ethical implications. More specifically, Schrier & Gibson (2010) note that by permitting players to take on new identities, to experience the consequences of their decision making and to iterate on those consequences, video game play has inherent ethical implications that also make games well suited to ethical exploration.

The intersection of games and ethics is an area approached at multiple levels from a variety of perspectives. Some commentators, such as Bogost (2008) and Sicart (2009a), have analysed the concept of game-as-medium in considerable depth, shedding light on the ethical dimension intrinsic to that medium. Schrier (2014) observes that some are interested in how games, as art form and medium, express the creator's values, and how this may potentially influence or interact with one's audience. Those values, expressed by games and through gameplay, are also interpreted and investigated as embodiments of a broad culture gravitating around the games industry and the audience that industry caters to and helps cultivate. As Schrier (2014) points out, concerns about game ethics also focus on the modes of game production, distribution and marketing, and the ethical considerations of developing and selling games.

In the light of the different perspectives on ethics and gaming, this section begins with a look at some different approaches academics have taken to the topic, as briefly touched on above. This background discussion embraces different manifestations

of "gamefulness" or "gameful interaction" (Deterding, Sicart, Nacke, O'Hara, & Dixon, 2011), including gamification. The section then goes on to examine some particular issues emerging from the literature that can be identified as ethics-related or that in any case have ethical implications, such as games and violence, and games and identity.

Background

The field of ethics is broad and complex, so it could be helpful to begin with a definition of terms. In her investigation of game ethics, Schrier (2014) offers the following explanation to distinguish between morals, ethics and values:

> *Typically, morals refer to "universal truths, or public rules or principles" (Tierney, 1994, p. ix), or agreed-upon, more general guidelines. Ethics, on the other hand, usually are referred to as a more individual, active way of handling morals, an "individual's response to social morality in terms of reflective engagement, valuation, and choice" (Tierney, 1994, p. ix). Likewise, Sicart defines ethics as the practice of making choices and moral judgments to achieve a good human life (Sicart, 2005). The term "values" is also typically found alongside "ethics" and "morals" and are usually the output of one's ethics and morals—these are the principles or guidelines that define what matters to a person, organization or society.*

Describing some game developers' early attempts to create "ethical" games, Sicart (2010) notes how in most cases the player simply negotiates a narrative-based decision tree on the reifies a binary good/evil moral system hardwired into the game design (p.2). Highlighting the serious shortcomings of this approach, he describes how it gave way to the emergence of a more articulated vision of game ethics, citing as a practical example the practice of Value Sensitive Design (Flanagan & Nissenbaum, 2014). Sicart (2013) proposes a high-level, theoretical model of game ethics from a game-as-medium perspective. He contends that games engage players' moral expertise through stories and systems, and the friction between them (Formosa, Ryan, & Staines, 2016; Sicart, 2013), suggesting that ethical gameplay is ''the result of the ways in which different choices, dilemmas, situations, and contexts are created by the interrelation between the procedural and the semiotic in the context of play''(p. 60). In his book "The Ethics of Computer Games" (Sicart, 2009b) he describes his vision thus:

> *"The ethical game is not that which evaluates the players' actions according to predetermined moral systems embedded in the game, but that in which the ethics of the game experience and all its elements are reflected on and visible in the game design, in the game experience, and in the game community. A good game has been designed keeping in mind that creating computer games as objects is a moral act, that the design of the game can have ethical affordances, and that the game is going to be experienced by a moral agent. This moral agent has to perceive the game as an experience where she can exert her moral judgment as a player, where she can create the values that will guide her gameplay, and where her ethical virtues are respected. The resulting game experience has to be communicable to other players who will understand, share, and/or contribute to creating the values of that game in the community." (Sicart, 2009b, p. 207)*

As Versteeg (2013) points out, this view resonates with Bogost's interpretation of video games as procedural rhetoric (Bogost, 2008), in that players subject themselves to an ethical framework defined by the game's rule-system but retain the ability to reflect on that framework as moral agents in a culture outside that of the videogame world. (p.38). This is consistent with Will Wright's view of the video game as a "possibility space" (Jensen, 2013, p. 69). To Sicart (2009b), the (critical) ethical reflection that the player is afforded within the game experience is sine qua non for ethical gameplay. Drawing on the work in Information Ethics (IE) of philosopher Floridi (2002), Sicart posits the digital game as an infosphere (Sicart, 2009b, p. 195) comprising a procedural level (the system of rules and game mechanics) and a semantic level, i.e. the gameworld of abstracted metaphors that the player, acting as an ethical agent, translates through game experience but also in terms of her experience of the (real) world outside[14]. Thus, in Sicart's view, the player develops an ethical persona that

14 This view resonates with the definition of gameplay proposed by Ke (2016): "the construct of gameplay [has] two main components—game mechanics (i.e. gameplay rules and actions) and the game narrative (i.e., game-world design, comprising scenarios, the storyline, and/or characters)" (p.223). It could also be argued, however, that gameplay is the result of *interaction* between a player and these two elements within a gameworld – see Section 7.1.

is at the same time coherent with the in-game world, and with the external values of the player as an ethical being.

A concrete example of this approach to ethical engagement in video games comes from Formosa et al. (2016, p. 212), who examine the ethical and moral dimension of the highly acclaimed *Papers, Please*, a prime example of what (Zagal, 2010) calls ‘‘ethically notable video games’’, namely those that “provide opportunities for encouraging ethical reasoning and reflection.” The authors contrast the systemic approach adopted to the ethical design of *Papers, Please* of the kind advocated by Sicart (2010) - as outlined above - with the more common scripted (or branching-narrative) approach. Their analysis is based on the Four Component model of moral expertise developed by psychologist Narvaez (2008) (for more details, see Section 7.4.7. Recommendations).

While some have approached game ethics from a theoretical/philosophical perspective, others have focused more specifically on the pragmatics of game design practices. This effort is directed towards encouraging and supporting game developers to recognise, reflect on and operationalise the values that – consciously or otherwise - underpin the design process and hence also the game experiences that their designs ultimately reify. A prime example of this approach is the Values at Play (VAP) initiative developed by Flanagan & Nissanbaum (2014), described below in Section 4.7.2 State of the Art.

4.7.1. Methodological specificities

As reported in Fig.7, the dataset generated from the initial query and filtering (Steps 1-3) comprised 91 papers pertinent to the ethics perspective. The title, abstracts and keywords of these records were subsequently analysed to assess the relevance of each item with respect to the scope for the ethics section of the literature review expressed through the adopted search query. This relevance filtering resulted in the further exclusion of 44 items, leaving 39 records.

As reported in Section 4.3 Methodology for the analysis of the academic perspectives, coding was dedicated to literature reviews and meta-analyses. Given that in the ethics perspective only three of the 39 filtered records fitted this category, the

need arose to broaden coverage for the state of the art analysis. Thematically, the filtered dataset generated for ethics was dominated by studies investigating a single issue: the relationship between game play and player aggression and violence (27 out of 39 records). A further five items were dedicated to identities and gaming, mostly concerning issues such as sexism and the role of women as game characters and members of gamer communities. Full-text analysis also revealed that four items actually fell outside the inclusion criteria. In light of these outcomes, we sought to gain a broader picture of games and ethics research through the map of author-defined keywords harvested from the raw, unfiltered database of ethics-related papers generated by the literature search (see Fig.13 below).

A few indications of a very general nature emerged from analysis of the resulting map. Issues pertaining to violence and aggression figure very prominently and are closely interrelated. These correspond to the light-green cluster on the right, which gathers some other psychological and behavioural aspects, including prosocial. The red cluster on the left is largely dedicated to questions of identity, diversity and inclusion, especially regarding gender and sexuality; some proximate ochre tags (e.g. discrimination and prejudice) are thematically related to this cluster. The cyan and pink cluster at the top are more varied but appear to embrace issues related to youth and to disability and special needs. Tags in the yellow-olive spectrum and those in the blue spectrum stretch across the main clusters, with low-level coverage of a wide range of topics. Tags of various game types (games, videogames, digital games, serious games, gamification, etc.) are spread across the different map clusters.

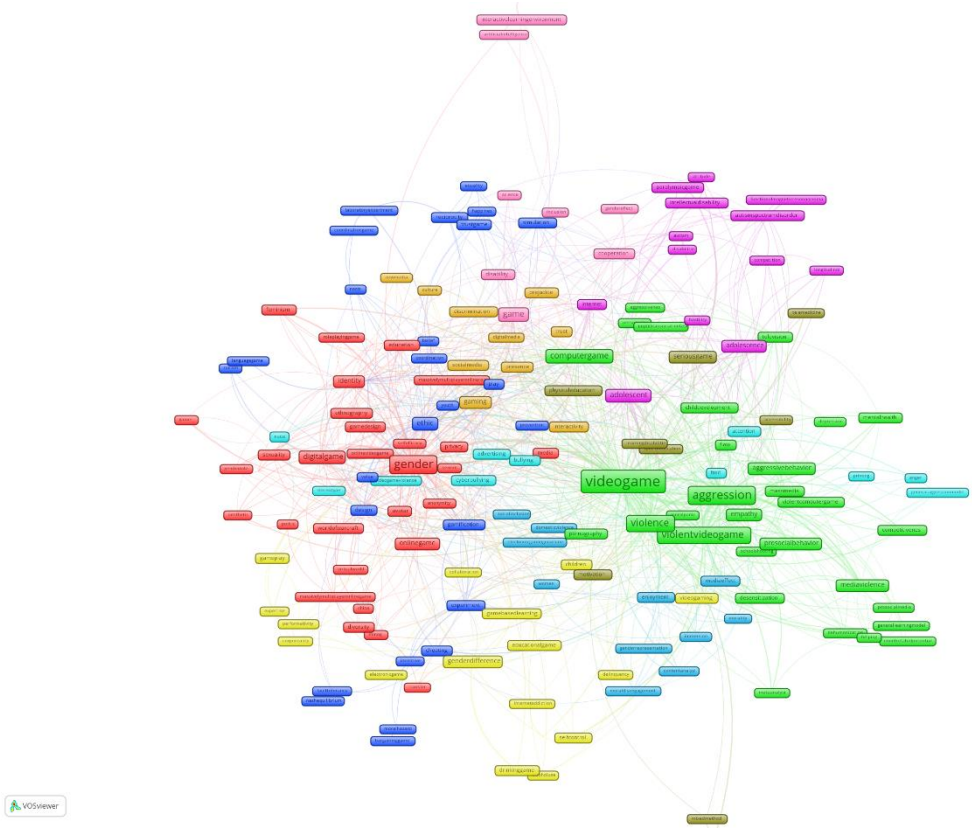

Figure 13. Map of keywords for the Ethics Perspective of the Gaming Horizons literature review – for a more detailed view, go here - https://goo.gl/kIwuVF

4.7.2. State of the Art

The state of the art on games and ethics-related issues reported here essentially reflects prominent areas of research interest that have gained attention over recent years in academic journals in terms of author citations. Given the limitations that this citation-based filtering entails, an attempt has been made to position these core findings in the broader landscape on games and ethics research. This effort is reflected both in the Background section above and in the state of the art described hereunder. Consultation of the keyword map shown in Fig.13 provided a basis for selecting supplementary papers located both inside and outside the original raw dataset retrieved from the literature search. In the former case, priority was assigned to literature reviews and meta-analyses.

The topic grouping in this section coincides with the spectrum of ethics-related issues covered in the keyword map and the set of papers resulting from the literature search, covering violence/aggression questions, followed by issues related to identity,

diversity and inclusion (gender, sexual identity, race, special needs). Given the substantial body of existing research - both theoretical and practice-oriented - in ethical game design, this aspect is also covered, as is the very topical emerging issue of ethics and game monetisation. The state of the art overview also addresses the different game types considered for this literature review.

4.7.2.1. Violence and aggression

As many top-selling video games feature violent content (Dill, Gentile, Richter, & Dill, 2005), concerns have been expressed for some time about the possible impact this may have on players, especially among the young. In light of the increasingly pervasive nature of game play (Boyle et al., 2011), a causal link between violent video game playing and increased aggressive or violent behaviour could have tremendous personal and social consequences.

For a number of years, research in this field has been the subject of intense public and media attention. Much of the impetus for this have been driven by a series of shootings in the USA perpetrated by young attackers, e.g. 2011 Utøya shooting, 2012 Sandy Hook elementary school shooting, 2012 Clackamas Town Center shooting. In the wake of these atrocities, several claims were made in the media that the perpetrators may have been influenced by violent video game playing.

For these reasons, the effects of violent video games on aggression and violent behaviour, especially among children and adolescents, have been closely studied in recent years. Research findings, and meta-analyses of the research results produced by different teams, have pointed in contrasting directions, however. The meta-analyses conducted by Greitemeyer & Mügge (2014) and Ferguson (2015) conclude, respectively, that violent video games do and do not influence aggression; they also diverge on the 'positive' effects of games, i.e. that game playing enhanced prosocial behaviour. This inconsistency of results is due in part to the different inclusion criteria adopted for the two meta-analyses; Ferguson (2015) focuses on children and adolescents and excludes studies conducted on college students, while Greitemeyer & Mügge (2014) applied no age group exclusion criterion.

At the same time, however, a pattern of methodological issues in the field emerges from both meta-analyses. Specifically, experimental and correlational studies

on the effects of video game playing are wildly heterogeneous, using different games and different measures of aggression. Even the measures used in multiple studies, such as the Taylor Competitive Reaction Time Test (Epstein & Taylor, 1967), have been criticized for their lack of standardization in implementation and limited generalizability to real-world aggressive behaviour (Elson, Mohseni, Breuer, Scharkow, & Quandt, 2014; Christopher J. Ferguson, 2015; Christopher J. Ferguson & Rueda, 2009). Lastly, different studies control for different confounding variables, some directly considering zero-order correlations (e.g. Greitemeyer & Mügge, 2014), some controlling only for gender (e.g. Przybylski & Mishkin, 2016), and others still including several variables as covariates (e.g. Willoughby, Adachi, & Good, 2012). The use of different measures of aggression and the process of control variables selection are two factors that can potentially lead to selective reporting of results, so that only results compatible with the authors' preferred explanations are discussed (Christopher J. Ferguson, 2015). This compounds the ubiquitous problem of publication bias, a particularly dangerous risk in research fields where academic - and public – debate is contentious and heated. Unsurprisingly, and most troublingly, the meta-analyses conducted by Ferguson (2015) and by Greitemeyer & Mügge (2014) both report the existence of publication bias but in opposite directions, i.e. mitigating against their respective findings. This raises questions about the way in which researchers in the area assess the research landscape, making it even more difficult to reach any definite conclusion on the effects of violent video games.

An even more fundamental problem, however, may lie at the root of the heterogeneity of results from studies into violent video gaming, namely the definition of violent video game itself. As argued by Ferguson (2015), most video games can be considered violent when a very broad definition of violence is adopted. Classifying games as either violent and nonviolent may not be the most useful approach for evaluating their impact on behaviour. Furthermore, inappropriate matching with the violent and nonviolent condition could mask the effect of other variables. Indeed, studies that classified games according to their collaborative or competitive gameplay found that cooperation in a violent video game can nullify and even reverse the negative behavioural effects of violent content (Ewoldsen et al., 2012; Velez, Mahood, Ewoldsen, & Moyer-Gusé, 2014). It has even been suggested that competition - and not violent

content - may be the key variable for understanding the effects on violent or prosocial behaviour (Adachi & Willoughby, 2011a, 2011b).

Recognising the need to unpack the concept of violence in game content, Hartmann, Krakowiak, & Tsay-Vogel (2014) conducted the first systematic study into the prevalence of moral disengagement mechanisms (Bandura, 2002) in violent video games. These are factors that help players accept game violence and have an enjoyable, largely guilt-free game experience, even though research has established that players tend to perceive virtual opponents as social beings and not a mere bunch of pixels. Moral disengagement mechanisms "distort the consequences of violence, dehumanize opponents, and provide cues that assist users in morally justifying virtual violence", e.g. battling against ghouls, responding to (unprovoked) attack, fighting for a 'good cause', being rewarded for violent feats, or witnessing little or no portrayal of victims' suffering.

As well as reviewing recent literature on moral disengagement in violent video game play, the authors conduct a detailed systematic content analysis of narratives and actual game play in 17 popular, top-rated First Person Shooter (FPS) games to empirically verify "the (so far untested) assumption that virtual violence is often accompanied by moral disengagement factors." They find that moral disengagement factors are indeed frequently embedded in FPS games (and, accordingly to the literature, in other violent video game genres as well), albeit in varying degrees of intensity; factors related to the justification and the dehumanization of violence are the most prevalent. The 'typical' top-ranking AAA FPS game that emerges from the study features a morally black-and-white conflict (76.5%) in which a (90.9% Caucasian) good guy battles mostly (54%) non-human, atrocity-perpetrating (88.2%) opponents in a setting that is at least partly fictional.

4.7.2.2. Identity and diversity

Those voicing ethical concerns about games on questions such as violence in game content and identity stereotyping/marginalization often associate those concerns with an idea of the prevailing games culture, particularly the presumed predominance within that culture of a specific demographic: young white heterosexual males. This (stereo)typical identity is assumed by many to be practically synonymous with the image of a 'gamer', to be pervasive among game industry professionals, and even to

dominate character representation within video games themselves.

In this regard, Chess, Evans, & Baines (2016) report that in the early days of the gaming industry, video game technologies were primarily designed by men for male audiences, and this carried through in the industry's advertising. The archetypal gamer was generally perceived as being a white, heterosexual man, even if this did not accurately reflect the actual market demographic (Jayanth, 2014; Shaw, 2012). The authors argue that the industry was slow to shift from this stereotype, perhaps failing to distinguish the position of so-called 'hardcore' gamers within the broader game-playing audience. Their study of 5,036 US-based video game television commercials aired in 2013 revealed that, when women appeared, they were shown as players only in 22% of cases, while the corresponding figure for men is more than double (48%); where there was a main character (52%), this character was overwhelmingly white (67%) and male (90%). The authors state that "even with the emergence of next-generation systems and shifting landscapes in gaming, there is still a cultural perception of the gamer as white male" (Chess et al., 2016, p. 53).

Klopfer, Osterweil, & Salen (2009, p. 7) equate the category of 'gamers' with "power gamers", namely players "with high end, game-tuned computers and peripherals, gaming skills that they have developed through near countless hours of game play, and the disposable time in which to invest in these games.". The authors point to research indicating that, as early as 2006, power gamers represented just 11% of the US gaming community. They present a nuanced categorisation of the gaming community that, together with power gamers, also comprises social gamers, leisure gamers, dormant gamers, incidental gamers, and occasional gamers.

As Shaw (2012) indicates, much research effort over the years has been directed at challenging the dominant image of the archetypical gamer as being a white, heterosexual, male, teenager. At the same time, many researchers have sought to quantify what is seen as a lack of diversity in game content, typically in terms of gender, race, and sexuality. Shaw questions the way in which researchers investigating gaming and identity tend to label all players, including members of marginalized groups, as gamers simply by virtue of (game-playing) actions. She advocates great attention to whether and how players actually perceive and associate (or not) with the 'gamer' identity. In calling for a more nuanced view of the gamer identity, Shaw notes the

discrepancies (in identity and behaviour) between the so-called hardcore players and players of casual games (see Wohn, 2011, reported below). As part of this effort, she conducted an ethnographic study of members of marginalized groups who play video games, concluding that "normalizing video games for all audiences, finding ways to emphasize their 'everydayness' in contemporary media culture, is a more productive approach to demands for representation." (p.40)

4.7.2.3. Identity - gender

Researchers investigating identity in video games – and video gaming culture – have focused particularly intensely on gender issues. The level of interest here can be gleaned from a glance through the keywords of contributions to the conference of the Digital Game Research Association (DiGRA)[15] held annually since 2002: interestingly, "gender" is one of the top five most commonly adopted keywords, even ranking above "learning" and alongside "serious games", two core topics in games research.

Numerous studies have investigated the representation of women as characters in games, pointing both to underrepresentation and stereotyping. They have also highlighted the marginalisation of women in gaming communities, as game developers and as game industry professionals. The boom in digital gaming over recent years as a pervasive leisure and cultural activity has seen a significant shift in the gender profile of the game-playing community. For example, girls and women currently comprise 44% of all game players in the USA, with women aged 18+ constituting a larger segment of the game-playing population (33%) than boys aged up to 18 (15%) (Entertainment Software Association, 2016). In spite of this, debates on gender issues persist, as indicated by the high level of research being conducted in this direction. The dominant themes addressed in the highly cited papers included in this literature review of games and ethics are clearly videogame violence and gender.

The pervasiveness of gaming as a leisure (and also non-leisure) activity among young people whose social identity and attitudes are still talking shape makes gender in games an increasingly important matter. This is especially true in the light of research

15 http://www.digra.org/digital-library

showing that stereotypes towards women in gaming contexts contribute to real world prejudices (Kaye & Pennington, 2016).

Lynch, Tompkins, van Driel, & Fritz (2016) conducted a landmark systematic study of playable female characters appearing in 571 video games published over the past three decades. The authors conclude that the view of female game characters as being grossly sexualized appears overstated, finding a general decrease in the sexualisation of female characters after 2006, especially in primary characters (the sexualisation of secondary characters was comparatively higher). They attribute this positive result to a number of interrelated factors, including women's increased interest in gaming, greater participation in the industry (3% of the workforce in 1989 versus 22% in 2014), as well as heightened pressure and criticism levied at the industry's arguably male hegemony (Williams, Consalvo, Caplan, & Yee, 2009).

The authors acknowledge that games with playable female characters constitute a particular segment of the general video games market. While they report an overall increase in the number of playable female characters appearing in games, the authors also report that the percentage of female protagonists has not grown, and more female characters filled secondary roles than primary roles in the sample. They associate this result with commercial pressures, suggesting that publishers may consider male protagonists as a less of a risk (Lynch et al., 2016, p. 578). In addition, they note that overtly sexualized portrayals persist in some game genres primarily targeted at boys and men, such as shooting games. Conversely, RPG games featured the lowest rate of sexualisation among games in which the protagonist is actually represented on screen.

The authors also found confirmation of the so-called 'Lara Phenomenon', whereby women are portrayed as sexualized and also capable characters, in the manner of the highly successful franchise based on the *Lara Croft* character (Fig.14). While acknowledging the positivity of perceived capability in female characters, they see its portrayal through the lens of the 'male gaze' as ethically questionable, in the same way as the 'objectifying gaze'. They go on to provide suggestions that game developers and regulating authorities might adopt to ameliorate women's representation and participation.

Wohn's, 2011 study of casual games provides a very different picture indeed in terms of gender. Analysing over 250 titles produced by the top five casual game publishers, the author shows that character representation in casual games is overwhelmingly female and non-stereotypical. This is probably a reflection of the very different audience for casual games: according to the Casual Games Association, in 2010 over 200 million people played casual games each month over the Internet, the majority of whom were women. In the light of these findings, the author offers recommendations for a more nuanced view of gaming and game culture in the research sector.

A major barrier to a more equitable gaming culture is perceived antagonism to female participation in gaming communities. Investigating the attitudes of 300 online gamers, Fox & Tang (2014) seek to unpack the personality attributes behind sexism in gaming communities. They find that these can mainly be predicted by social dominance orientation, a trait possibly rooted in men's desire to maintain their dominant position in the gaming community or perhaps to "express social dominance in the virtual world in a way they cannot in the physical world" (p. 317). The resulting sexist milieu "may be driving women away from many networked games or forcing them into silent participation rather than active engagement". Given that women's motivations for playing games are very similar to men's (Taylor, 2006; Yee, 2006) … "it is likely not the game itself that is keeping women from becoming more vocal participants … (but) the game culture." The authors go on to suggest measures that gaming studios - and gamers themselves - could take to change that culture.

Fisher & Jenson, (2017) draw attention to "the specific sociocultural conditions that produce and naturalize gendered exclusion," criticising the mainstream game industry for its "wilful blindness to the changing desires, demands, and demographics of digital games culture" through marginalisation, sexualisation and 'pinkification', i.e. production of stereotypical games-for-girls. With this in mind, they study game designs produced by young participants in Canadian youth camps. They find that girls in mixed groups tend to produce games with 'good-girl' themes (pink or educational), possibly to 'flag' their female identity, while those in all-girl groups, not facing the same need to assert gender identity, display no such tendency.

Additionally, empirical research is now indicating that gender stereotyping and exclusion also impacts on actual game performance. In their study of women as gamers, Kaye & Pennington (2016) establish the negative impact of 'stereotype threat' (Steele & Aronson, 1995) whereby women's perceptions of competence are undermined by stereotype-salient cues, hindering their actual game play performance. However, it's not all bad news. The authors also show how the negative impact of 'stereotype threat' can be mitigated by female players' association with "multiple social identities", i.e. association with non-stigmatized player groups/identities. With this in mind, they suggest constructive steps that can be taken to enhance social integration in gaming communities and thus broaden and enrich the participation of women as gamers.

The negative impact on game performance from stereotype threat established by a number of research groups is confirmed by Ratan, Taylor, Hogan, Kennedy, & Williams (2015), who investigate women's participation in the enormous community gravitating around the highly popular League of Legends multiplayer online game. They find that stereotype threat affects female players' perception of their own abilities, even when those abilities are no different from those of males. In addition, they show that, as well as constituting a very small segment of that community, women are also less active and tend to assume supporting, rather than protagonist, roles. An explanation for this, emerging from their research, is that most women play the game with a romantic partner and thus "find themselves expected, if not required, to stand by their man." This may result in them refraining from intensive play and/or experimentation with other game roles, which in turn perpetuates stereotypes. Finally, the authors report the concrete steps that the publisher, Riot Games, has taken towards supporting equity in the League of Legends community (McWhertor, 2012).

With respect to games and identity more generally, (Nielsen, 2015) highlights the unique opportunities that Role Playing Games (RPG) offer for players to establish their (gender-racial-sexual) identity by "play(ing) who they are" in the digital world. In this light, she stresses the need to support full diversity of representation in RPG, both as personal affirmation and as a counter to harmful stereotyping.

4.7.2.4. Sexual identity

Shaw & Friesem (2016) report their efforts to document lesbian, gay, bisexual, transgender, and queer (LGBTQ) content appearing in video games over the past 30

years. The aim of the research is to compile an online archive, which lists over 350 games and over 500 content items. The latter comprise both explicit and implicit forms and are classified into nine different categories (characters, relationships/romance/sex, actions, locations, mentions, artefacts, traits, queer games/narratives, and homophobia/transphobia) which the authors developed using a Grounded Theory approach. They acknowledge that, in many cases, games do not explicitly define these characters' sexualities, and so the process of untangling implied sexuality is a contentious one (Adrienne Shaw & Friesem, 2016, p. 3380). The authors find that most LGBTQ content in games is largely inconsequential to game progress. With regard to characterisation, explicitly LGBTQ playable characters (PCs) are rare: most examples are non-playable characters (NPCs). As to gender, they state that "representations of explicitly transgender, non-binary, genderqueer, and intersex characters are less common in games than of homosexual and bisexual characters, and most of them appear in more recent games" (Shaw & Friesem, 2016, p. 3882). The authors propose the archive resulting from this study as a foundation for further LGBTQ gaming research and make some suggestions for future research directions.

4.7.2.5. Race identity

The results from the searches of academic literature performed for this literature review reveal that issues of race identity are rarely addressed in specifically dedicated papers. They most commonly appear in studies considering 'minority' identities as a whole, in studies of individual games / game communities (e.g. Brock, 2011) and almost exclusively before 2012. By contrast, fairly recent press reports on these issues are more common, as is coverage in major games blogs.

A survey of over 200 adults in the USA conducted by Pew Research Center in 2015 revealed that 53% of black adults play video games, 11% of whom are self-described "gamers." For white adults, these figures were 48% percent and 7% percent, respectively (Duggan, 2015). By contrast the IGDA Developer Satisfaction Survey 2015[16] reports that only 3% of game developers describe themselves as black/African/African American, while 76% of developers identify themselves as white.

16 https://www.igda.org/?page=dss2015

As reported above, the study of game industry television advertising conducted by Chess et al. (2016) found that, where a main character appeared (52%) in a commercial, that person was generally white (67%), although most advertisements (53.9%) actually included ethnicities other than white. This suggests the stereotype perceived and portrayed by the gaming industry persists, although this is less strong than for gender representation.

Wohn (2011) notes the general dearth of studies dedicated to race representation in games and comments that those conducted (Dill et al., 2005; Williams et al., 2009) found a solid prevalence of white characters. Her own analysis of race representation in casual games found an even stronger white overrepresentation. Out of the 130 games with human characters drawn from a 200-game random sample, only 6% featured non-white primary characters, while in the 54 most popular casual games in a second sample 92% of human characters were white. These findings on inclusive representation are in sharp contrast with those she reports for gender in casual games, where the stereotype is actually reversed (see above).

4.7.2.6. Inclusion: special needs

The results from the searches of academic literature performed for this section of the literature review (see Section 4.3 Methodology) reveal that issues related to gameplay by users with special needs and/or specific and non-specific disabilities figure very rarely in mainstream academic literature, with next to no coverage in the last few years. The few studies that address this sector are mostly concerned with the use of applied / serious games and game based learning strategies to support the acquisition of literacy, academic or work-related skills by players with Intellectual Disabilities (ID).

In their review of the literature on empirical research into the impacts of video games on intellectually disabled players, Jimenez, Pulina, & Lanfranchi (2015) managed to locate just 11 studies conducted over the past decade that have generated data on the effects of Intellectually Disabled (ID) gameplay. These reported positive outcomes on aspects of ID cognitive performance such as choice reaction time, attention and decision making. However, the studies were mostly very small scale, ranging from case studies with a few participants to a maximum of 60 subjects. Stressing the need for further research in the area, the authors place particular importance on the investigation

of medium/long-term effects, as well as study of possible negative effects of video games on ID players.

Yuan, Folmer, & Harris (2011) analyse the accessibility of video games using a simple interaction model (receive stimuli, determine response, provide input) and examine the issues that each of these steps entails for players with visual, hearing, motor and cognitive impairments. On this basis, they examine the strategies that can be adopted to deal with each impairment type at each step; strategies include both design factors and employment of assistive technologies. They also survey a number of existing games that implement such strategies and provide indications for both game design/development and game marketing that could support accessibility and thus broaden access to games by all potential players.

4.7.2.7. Values-Sensitive Game Design

As mentioned in the Background section above, the work of Flanagan & Nissenbaum (2014) in values-sensitive game design over the past decade has led to a major research initiative under the banner of Values at Play (VAP)[17]. In the first instance, this effort was aimed at raising awareness about the need for values sensitivity both in game design and in game development education. As VAP evolved, the authors also sought to provide tangible support for the systematic integration of values in game development.

In its original form (Flanagan & Nissenbaum, 2007), the VAP methodology comprised four activity phases (Values Discovery; Identification of Values-Based Conflicts; Implementation and Prototyping; Values Verification) and was accompanied by a checklist of core values such as diversity, justice, inclusion, equality, etc. (see Appendices Section 7.4). In later publications dedicated to VAP, the authors propose a five-step iterative VAP Development Cycle coinciding with phases typically undertaken in game development: planning, requirements review, analysis and design, implementation, verification and evaluation (Flanagan & Nissenbaum, 2014, p. 77). VAP has also published various playable design games intended to operationalise the VAP framework and provide concrete support for integrating the ethical dimension in

17 http://valuesatplay.org/

the game development cycle and in game development education, including a game design curriculum (Flanagan & Nissenbaum, 2014, p. 142).

4.7.2.8. Game monetisation

As the platforms for playing and distributing video games have evolved and diversified over recent decades, so have the strategies adopted for monetisation games. In recent years, a number of questions have been raised about the ethical nature of those strategies, particularly regarding the way they leverage - or exploit - the strong (sometimes compulsive) pull that gameplay can exert on players. Heimo, Harviainen, Kimppa, & Mäkilä (2016) note that while the ethics of gambling has been the subject of close research attention in the field of business ethics, the same is not true of video game monetisation, with only sporadic studies being conducted. Fully acknowledging the fundamental necessity for revenue raising in gaming, the authors survey different monetisation strategies against the framework of Aristotelian virtue, recognising that, seen through this lens, "almost all the monetisation options seem somewhat unethical". Nevertheless, they argue that the developer's virtuousness ultimately serves to make the game (morally) good. They group game purchases into three main categories:

- traditional - pay once, freeware, shareware, lure-to-p(l)ay, pay-periodically
- pay while playing - pay-to-skip, pay-to-win
- content and access - downloadable content (DLC), add-ons, expansions, etc.

As a case in point (in the negative), they offer the example of pay-to-skip, where the player effectively buys a shortcut, i.e. makes a real money payment to skip over a (less engaging) passage in the game. Categorising short-cutting as non–virtuous *per se*, they argue that "a good developer is one who challenges their players to develop, to overcome themselves and to be better [...] the developer who tries to lure others into not being virtuous cannot be virtuous in the first place." A similar argument is offered for pay-to-win strategies, e.g. when a player can pay for better ammunition and thus increase the likelihood of winning the game. They define this as "cheating in an institutionalised form (that) changes the game from a competition where the best player wins to a question of who wants to and can pay the most. This ensures that the player does not develop as a player, but instead as a payer".

4.7.2.9. Purposeful games and gaming

As indicated in the Background section, the quest to engage players in entertaining, playful/gameful experiences necessarily entails an ethical dimension to some degree. Ethics assume particular significance when a game is conceived (or deployed) with the *express* intention of generating cognitive, affective and/or behavioural changes that last beyond the game experience and that are presumed to be of benefit in contexts outside the game's possibility space. Purposeful gaming of this kind includes the fields of serious games (or purposeful games) and Game Based Learning (GBL – Hamari et al., 2016).

Specific ethical questions arise when games are employed in formal education and training, contexts in which participation in gameful activities is - more often than not – compulsory. This condition alters what some hold to be a fundamental tenet of gamefulness, namely voluntary participation (McGonigal, 2011). Participants in formal education are bound by an educational contract that typically requires them to relinquish control (autonomy) over the methods and strategies adopted for actuating their learning. This limited autonomy raises a number of ethical issues, especially in the case of very young learner/players, who are particularly vulnerable to manipulation. In their exploration of ethical issues involved in the design and development of games, simulations and virtual worlds for learning purposes, Warren & Lin (2012) raise the question of the chain of responsibility linking the designer, the educational institution and the teacher, pointing out that value assumptions are inherent in the selection of theoretical approach, conceptual framework and application of information (p.3). They stress the need to consider the cognitive and social impact of gameplay on young students, especially any potential negative impacts that might outweigh the possible benefits gained. Special consideration is called for here in the case of gamification, as discussed below.

Another aspect of ethics and applied gaming is the adoption of games (and game design) to the teaching of ethics and the development of ethical thinking skills. Formosa, Ryan, & Staines (2016, p. 212) point to the growing consensus among academics that notable video games can have educational value as promoters of prosocial values and moral development, in addition to their critical and aesthetic value. A major contribution in this direction has come from the work of Karen Schrier (e.g.

Schrier, 2014, 2015), who has sought to broaden the focus in this field from the teaching of values through games to the investigation of how games can be harnessed to foster ethical thinking and to develop the skills associated with it. Schrier suggests that:

> *Ethical thinking is not just about following some agreed-upon code of ethics, or the existence of one right way to do things or how to act. Rather, it is about being able to think critically about the questions and moments in one's life, and judging the right thing to do in a given context, space, or culture […] (the) individual needs to be able to reason, reflect, empathize and gather information to judge how to best behave, act, share or choose. A game, therefore, should focus on teaching the skills associated with ethical thinking rather than merely posit which behaviors or concepts are right or wrong. (Schrier, 2014, p. 143)*

This view resonates with Sicart's vision (described above) of the player as moral agent within an ethical framework defined by the game's rule-system. It also shares a priority on providing opportunities and affordances for that agent to reflect ethically on the (game) behaviour.

Schrier (2014) proposes a model for conceptualizing and assessing ethical thinking in role-playing video games. This comprises four categories of ethical thinking skills/processes (reflection, information gathering, reasoning, and empathy), each of which is matched with drivers to form a model underpinning ethical decision making in games (see Appendices Section 7.4)

In his analysis of ethics in gameplay, Zagal (2010) proposes the concept of the ''ethically notable videogame'', namely one that "provides opportunities for encouraging ethical reasoning and reflection." He uses this concept as the basis for analysing a set of games that, in his view, fall into this category; these stretch back to the very early days of video gaming, e.g. *Ultima IV*: *The Quest of the Avatar* (UIV), published in 1985.

4.7.2.10. Gamification

Gamification has attracted considerable research interest in recent years (Caponetto, Earp, & Ott, 2014; Hamari et al., 2014). From the theoretical viewpoint, attention has focused on the definition of gamification and its positioning as a field in its own right in the games landscape (Deterding, Dixon, et al., 2011). Other studies have concentrated

on design issues (Pozzi, Persico, Collazos, Dagnino, & Munoz, 2016; Seaborn & Fels, 2015), on its application in the field and the impact generated (Hamari et al., 2014). The debate inside and outside academia on the relative merits of gamification has been characterised by considerable polarisation in positions. Advocates strongly proclaim the merits and potential pervasiveness of gamification, especially in the realm of business and commerce (Marczewski, 2013; Zichermann, 2011). Efforts have also been directed towards establishment of its effectiveness as a strategy intended to leverage motivational affordances so as to generate psychological and behavioural outcomes (Hamari et al., 2014). Detractors, especially those in the gaming community, see gamification as a reductive application of game mechanics that can be summarised by the moniker *pointsification*. This depreciatory term was coined by game designer Margaret Robertson who described gamification as "taking the thing that is least essential to games and representing it as the core of the experience" (Seaborn & Fels, 2015).

At the same time, the ethical and moral dimension of gamification has been the subject of strong debate inside and outside academia, with considerable polarisation ensuing. Indeed, the fiercest critic of gamification from an ethical viewpoint, Ian Bogost, considers it as an inherently exploitative practice, to the point that he famously dubbed it "exploitationware" (Bogost, 2013). Appraising the arguments advanced by proponents and detractors alike, Kim & Werbach (2016) identify a set of inherent tensions underpinning the theory and practice of gamification. Firstly, they point out that "gamification ethics is under-theorized … because the technological novelty and rapid adoption of the practice have outstripped careful [ethical] consideration." They also point out that gamification involves the overlay of two potentially clashing sets of norms, those pertaining to the virtual (game world) and those embedded in the real world. Hence the boundaries of the ''magic circle'' theorised by (Huizing, 1949, p. 10) become blurred, as does the transition to and from the norms inside that circle. Furthermore, the authors point to the inherent ethical tensions in reconciling the interests of the institution (the gamification provider) and the individual (player/participant), which may be at a variance.

With regard to the clash of game and contextual norms, it may be worth recalling the argument set out by Sicart on ethics and games (Sicart, 2009b, p. 5) to the

effect that while players submit themselves to the rule-system of the game, and hence to the ethical framework of those rules, they nonetheless remain moral agents within their culture and so must retain the capacity to reflect on the ethical framework that the game rules embody. Specifically on gamification, Sicart (2013) sees an inherent conflict between the largely competitive mechanics typically employed in gamified systems, such as leader boards, badges and points, and need to support the players' ethical reflection. He posits that game designs which limit the player's capacity to construct their own moral values for play and to act on them are unethical (Sicart, 2009a).

Kim & Werbach (2016) do acknowledge the ethical shortcomings generated by certain approaches to – and implementations of – gamification. They cite the example of an employer's use of leader boards to shame under-performing workers, recalling that "a competitive hierarchy that is innocuous within a game can be expressively pernicious in some social contexts" (p. 167). At the same time, however, they challenge the notion that, as a practice, it is inherently exploitative, manipulative, harmful, or detrimental to character, i.e. unethical per se. To illustrate this, they cite examples of gamification that could be considered ethically sound, such as game-like challenges used to crowdsource scientific research or gameful applications promoting healthy, weight-reducing behaviours.

The fact that the authors cite examples of what might be dubbed "prosocial" gamification underlines a broadening and diversification in the gamification landscape that has taken place since 2011, when Bogost dubbed it "exploitationware". Indeed in their 2014 literature review of empirical studies on gamification, Hamari et al. (2014) noted that among the gamification studies they reviewed (drawn from computer science and HCI conference proceedings), the most common application context was education and learning. The authors report that while the empirical outcomes from gamification in education are mostly positive – in terms of perceived motivation, engagement and enjoyment of learning tasks – negative outcomes are also present, for example competitiveness among students, often seen in a positive light, may also have stressful consequences. This result highlights the particular relevance of the ethical issues discussed thus far to the gamification of formal education and training, especially when these are compulsory (see previous subsection above). We can safely assume that the concerns which Warren & Lin (2012) voice about ethical design and employment of

educational games also apply to gamification, especially given the noted increase in adoption of gamified approaches in the education sector.

For Kim & Werbach (2016, p. 161), the degree to which gamification can be considered manipulative depends on questions of autonomy, transparency, consent and self-reflection, while exploitation should be seen in terms of voluntariness and fairness. The authors surmise that:

> *if a gamification system deliberately or negligently applies techniques to promote compulsive behavior, or fails to take corrective action when some players display such behavior, it falls short of ethical duties regarding manipulation (T. W. Kim & Werbach, 2016, p. 165).*

The critical question is whether the player's self-reflection – and therefore their autonomy - has been unjustifiably compromised: whether or not gamification is manipulative depends, in part, upon which account of autonomy is most adequate for the gamification context (T. W. Kim & Werbach, 2016, p. 164). This position contrasts with Sicart's, discussed earlier: Kim & Werbach cite addiction and distraction are specific threats to (ethical) self-reflection in gamification, whereas Sicart (2013) interprets gamification per se as a "distraction" from self-reflection.

4.7.3. Recommendations

In an effort to provide useful input for the various stakeholders groups in the gaming and gaming research sectors, this section reports the concrete recommendations that the above-cited authors have made regarding gaming and ethics on the basis of their investigations and research findings. The recommendations cover ethics in gaming generally, as well as in applied gaming and gamification. As an adjunct to these recommendations, there is a specific section in the Appendices (Section 7.5) devoted to the conceptual and operational frameworks that the cited authors propose as references and building blocks for ethically sound game design and analysis. The section also reports author-proposed lists of games relevant to ethics and ethics studies; a further section in the appendices (7.6) presents professional codes of ethics that have emerged in the field.

Violence and aggression

Recommendations on this topic mostly concern researchers and, to some degree, policy makers.

In their meta-analysis of current research into the effects of violent and prosocial video game play, Greitemeyer & Mügge (2014) find that playing violent video games increases aggressive behaviour, cognition, and affect, and decreases prosocial behaviour and affect. However, they also find that playing prosocial video games decreases aggressive behaviour, cognition, and affect, and increases prosocial behaviour, cognition, and affect (p. 581). Accordingly, they posit that the inclusion of prosocial elements in violent video games should attenuate harmful effects, as should cooperative play in a team (p. 585-6) (see Greitemeyer, Traut-Mattausch, & Osswald, 2012). They also recommend that "mainstream video game violence researchers should not be characterized as anti-entertainment media" given that they report "both negative and positive effects of video game play" (p. 584).

In his meta-analysis of current research into the effects of video game play on children and adolescents, Ferguson (2015) recommends that future research on the topic should take account of a number of control variables including gender, trait aggression, and family environment, as these generate substantially reduced effect sizes. He also reports widespread citation/selective reporting bias in video game research Ferguson (2015), another factor researchers (and others) should bear in mind when interpreting empirical outcomes. Another research recommendation is to differentiate research on exposure to video games from that on pathological gaming behaviours, such as missing school or work. The author advocates that the scope of research on the topic should be broadened to include the motivations driving young people's game selection and play habits, as well as more detailed profiling of the subjects involved, (e.g. family background / situation, social setting, membership of at-risk groups). At a more general level he notes that the hyperbole surrounding research into video game effects is at odds not only with (mixed) empirical findings but also epidemiological data, i.e. statistics show no dramatic rise in actual youth violence in correspondence with increased violent video game playing. The implication is that a more balanced view of research findings is needed. He also warns against blanket statements about outcomes for two reasons: media effects (game play vs no game play) may be small and variable rather than large

and ubiquitous; the term "violent video game" is ambiguous and might even be applied to almost any video game.

Gender

Recommendations on this topic concern game developers – and the gaming industry generally – as well as researchers.

Ratan et al. (2015) recommend that that game companies should address the social dynamics in multiplayer games, which often propagate stereotypes and facilitate hostility toward female players. Specifically, they suggest "addressing and curbing the toxicity and negativity that characterizes the majority of players' in-game verbal communication", thus helping to make the game more hospitable both for women and men. In this respect, they point to the steps in this direction taken by Riot Games (McWhertor, 2012) by introducing ''Honor'' and ''Reform card'' systems, through which players can either commend each other for positive and supportive behaviour or report each other for abusive behaviour. They also report that Riot Games has instituted a ''Tribunal System'' in which community members (i.e., players) review cases of repeated abuse reports and decide whether to pardon or punish the offending player.

In terms of the research agenda, they recommend that future research should examine pre-existing player relationships more closely to see whether and how gender dynamics play out in different configurations.

Kaye & Pennington (2016) advocate exploring strategies to reduce the potentially harmful effects of (negative stereotype) stigmatization, suggesting that "a reconsideration of the negative stereotypes and associated behaviours towards female gamers may be a fruitful avenue to pursue". They advocate game-based environments that foster more effective and positive forms of social integration between players, and encourage a greater sense of superordinate group membership, suggesting that these would help promote more favourable attitudes towards women within online gaming. To this end, they recommend support for the adoption of multiple social identities in gaming communities, which would help women to associate with a non-stigmatized gaming identity and therefore reduce stereotype threat effects. The authors' propose their multiple social identities framework as a theoretical basis to this end. More specifically, they recommend that games companies should reconsider how individual

performance indicators like status and level badges are used in gaming contexts as these social comparison cues may provide an implicit prime for players to associate gaming competence based on gender.

Fox & Tang (2014) suggest that sexism and its expression may be driving women away from many networked games or forcing them into silent participation rather than active engagement. They posit that is not the game itself that is keeping women from becoming more vocal participants in networked video games, but rather the prevailing game (community) culture. Accordingly, they recommend that additional measures should be taken to make gaming environments safer spaces for women and other minorities: “reporting systems should be more efficient, and moderators should be less tolerant of sexist, racist, homophobic, and otherwise discriminatory language that reinforces hostility and aggression towards ‘outsiders’”. In this respect, they also stress the responsibility of gamers, who “should also be mindful of the hypermasculine nature of networked games and its ability to alienate players. Even when harassment is not taking place, sexist language and other actions reinforce masculine norms and other features that may create a hostile environment." The authors recognise that an increase in women players could result in a shift, but do not exclude the need for official interventions such as sexual harassment policies.

Lynch et al. (2016) suggest that positive portrayals of female characters who are strong, capable, and attractive without overt sexualisation would help to encourage women to become interested in gaming and thus also contribute towards gender parity in the professional industry. They also believe non-objectified portrayals could foster more favourable and equitable attitudes toward women who play video games. They state that the trend toward decreased sexualisation of female characters, both in marketing and in game play, is promising for cultivating a more egalitarian game culture for all, especially if implemented without sacrificing the characters’ capability or prominence in the game.

The authors also recommend that more account be taken of character sexualisation in official game ratings as “we found that games rated Teen presented female characters as sexualized as the characters in games rated Mature”. To this end, they suggest that the Entertainment Software Rating Board (ESRB) system should include an additional rating for teens aged 15 and younger.

Wohn (2011) finds that, in stark contrast to research findings from studies into mainstream entertainment games, character representation in casual games is both overwhelmingly female and non-stereotypical in nature, probably a result of the fact that most casual gamers are women. In the light of her findings, the author recommends that future studies should investigate game effects more closely to see whether the different types of gender representation between casual games and typically-studied console video games develop different cognitive schema for players.

Chess et al. (2016) recommend that the video game industry should re-examine the way that players are portrayed in marketing. They suggest that a shift away from the standard portrayal of the archetypical gamer as a white male would help the industry to expand both in terms of overall sales and scope of audience.

Sexual Identity

Recommendations on this topic concern researchers.

In the light of their findings that LGBTQ content exists in video games in many different forms, Shaw & Friesem (2016) recommend that LGBTQ game studies should consider representation much more expansively than it has done already. For example, they posit that research on homophobia in online gaming would be better contextualized if scholars also account for the amount and types of homophobic content in games generally. Further investigation of same-sex romance options in games would shed light on other forms of LGBTQ representation. The authors suggest that research on new games with LGBTQ content should be better contextualized within the history of this content in digital games, and that game design could benefit from their research on how queerness can be integrated into all aspects of games.

Social Impact

Recommendations here regard educators.

In their evaluation of a co-designed game for teenagers addressing sexual violence, Gilliam et al. (2016) recommend that gameplay dealing with sensitive topics should always be paired with follow-up discussions led by adult facilitators. This need is affirmed by Crookall (2011) as a general principle underpinning effective deployment of serious games for educational purposes.

Game Design

Recommendations on this topic clearly address game developers. For more detailed recommendations on frameworks for ethical game design, see Appendices Section 7.5.

Zagal (2010) recommends that the game's ethical framework should be discernible and consistent. Developers need to consider whether the dilemma is moral, who it is posed to, how meaningful in-game consequences are and whether there is a need for emotional distance.

Sicart (2009) suggests a set of general principles to be used for the design of morally relevant gameplay:

- Create an ethically relevant game world;
- Do not quantize your player's actions: let them live in a world that reacts to their values;
- Exploit the tension of being an ethical player;
- Insert other agents with constructivist capacities and possibilities;
- Challenge the poietic capacities of players, by expanding or constraining them.

Gamification

These recommendations address researchers.

Rejecting the notion that gamification is inherently exploitative, manipulative, harmful, or detrimental to character - i.e. unethical per se - Kim & Werbach (2016) call on researchers to adopt "a more nuanced approach" to gamification ethics. In their view the critical question is ''What forms of gamification are unacceptable in which contexts, and which moral norms are primarily relevant to which contexts?".

4.7.4. Conclusive remarks

The predominant ethical concern emerging from the core of studies included in this state of the art study regards the psychological and behavioural impact of playing so-called violent video games. This is a highly controversial topic that continues to attract strong media attention. As reported in the State of the Art above, meta-analyses of

published research findings on this issue have offered contrasting interpretations, due in part to differences in focus and also methodology (Christopher J. Ferguson, 2015; Greitemeyer & Mügge, 2014). Doubts have also been expressed about the actual comparability of the field studies reviewed and the reliability/generalizability of the empirical data collected. In addition, research has yet to establish a generally accepted notion of what a 'violent' video game actually is, although – as reported – steps are being taken in this direction (Hartmann et al., 2014).

In their recommendations for further academic study on games and violence, the authors surveyed here call for greater research attention to factors like player motivation, profile, and context, as well as a better understanding (as mentioned above) of what video game violence actually constitutes. A take-home for game developers on the violence issue is the suggestion that including prosocial elements should attenuate potentially harmful effects of game violence, as should cooperative team play.

A broad ethical concern that also emerges from the academic literature regards identity. This centres on the inclusion/exclusion of different identity groups as players, as members of gaming communities, and as figures in the game industry, but also the way video games represent society and different social groups. The literature covered in this review is, in many respects, a response to the popular concept that games and gaming are dominated by a narrow social stereotype: the young, white, heterosexual male. The investigations reported here into how different demographics are represented and treated in gaming suggest that while the gaming market is growing and diversifying – and in the process shifting away from its 'hardcore' stereotypical roots – there is still much to be done it terms of developing a more diverse and inclusive gaming culture. In the eyes of the reviewed authors, priority should be given here to nurturing more tolerant and inclusive interactions among gamers both within and around game worlds. In this regard, community reporting and commendation systems are suggested as a way forward. Another recommended step is supporting the cultivation of multifaceted player identities and social groupings that cut across typical binary game community divisions like expert/novice, women/men. Sensitivity to the way individual player proficiency is represented is considered important here, as is gamers' own sense of social awareness and responsibility.

Some authors also call on developers (and the game industry in general) to consider representation within games, as well as the way it represents gamers and gaming to the world. They argue that things like less overtly sexualised portrayal of women and stronger 'minority' representation in games would - when combined with the steps suggested above – would help to make game culture more variegated and attractive, thus contributing to broaden participation in gaming and increase the customer base. Casual gaming is offered as a positive example in this regard.

Concerns about the potential manipulation of those participating in gameful interactions enacted outside of game contexts, i.e. in gamification, have also attracted academic attention. Here, concerns are expressed about the scope gamification does or does not allow for participant autonomy and self-reflection. As it turns out, these are also cornerstones for the ethical game design frameworks proposed by several of the authors included in this review (see Appendices Section 7.5). Authors surveyed here call on the research community to adopt a nuanced approach to gamification and the ethical concerns it raises by considering the appropriateness of applications in context, and the moral norms implied. This effectively places the academic perspective midway between polarised practice-based positions ("gamified life" vs. "gamification is bullshit").

An interesting finding from this review is that ethical questions connected with the monetisation of entertainment games is beginning to attract academic interest (Heimo et al., 2016). The authors note how different in-game monetisation strategies that have emerged in recent years present ethical tensions, especially when these strategies are integrated with core game mechanics. This calls into question the role of the game developer and the ethical implications of the wider game design process. In this light, the frameworks for ethical game design proposed by several authors covered in this review (see Appendices Section 7.4) may offer useful theoretical and practical support. As well as offering building blocks for more ethics-sensitive design practices, these could be foundations for making ethics an integral part of developer education and thus - ultimately - help to nurture a more ethical gaming culture.

4.8. Sociocultural & artistic perspective

4.8.1. Introduction

The following section offers a panoramic view of the cultural, social and technological impacts of the video games industry. It represents a departure from the more structured approach adopted so far, because its focus is not on scholarly outputs, but on "seminal" video games – actual landmarks that signalled important shifts in the public debate about digital interactive entertainment. In this brief introduction, we will provide a rationale for this section's inclusion, discussing its role as a companion piece to the systematic review: an essential contribution to a comprehensive mapping of gaming's epistemic landscape, entirely consistent with the methodological assumptions that underpin our project.

What does "seminal" mean? In the context of this project, seminal is a subjective categorisation based on expert knowledge of the video games field. This content represents seeds of information that can be investigated to lead to many wider topics of discussion, and that were lynch-pins for how gaming is framed in the minds of developers, players, academics, or the public, often via mainstream journalists. They are what an "insider" would qualify as significant games. The reason that justifies the inclusion of this rather interpretative perspective is grounded in the very nature of the domain we are investigating. While video games are, arguably, a vibrant but still relatively small area of academic research, they undoubtedly represent a large cultural field where much knowledge is produced at the intersection of economic necessity, "tacit" professional expertise, and discursive contestation. In particular:

a) Economic necessity means that the laws of the market shape relationships, expectations and measures of success in relation to video games. Gaming is, first and foremost, an industry regulated by supply and demand, financial investments, complex interactions between development, distribution and marketing and, not to be understated, sophisticated consumption patterns.

b) Professional expertise refers to the values and practices associated with game development. As a trade and a collection of professional

conventions and standards, game development is a context where a significant amount of expertise, arguably more so than in other knowledge-intensive professions (Cetina, 2010), is informal and inherently practical, developed through participation rather than acquired through formal training (Deuze, Martin, & Allen, 2007).

c) Discursive contestation refers to the ways in which gaming is positioned within a range of debates, as a topic of political or cultural controversy. While some aspects of this controversy have been object of scholarly attention (Massanari, 2017; Shaw & Chess, 2016), the ways in which games are "talked about" in society can be effectively gauged through a rapid historical analysis of high-profile instances, that is, by focusing on how specific video games or gaming-related incidents were featured in the mainstream or specialist media.

The three points summarised above constitute, in essence, an epistemological rationale. Epistemology means that in this complex sociocultural field a significant amount of knowledge is not formally expressed through the regimented language of scholarly engagement. Therefore, any attempt to review such knowledge that strives to be comprehensive in scope cannot be limited to the analysis of empirical research. It could even be argued that the systematic review of empirical evidence is necessary but not sufficient.

The following section about seminal games and their cultural impacts rests on this epistemological rationale and, crucially, it draws on the game development expertise in the project team, attempting to reflect what "seminal" means from a culturally-aligned industry perspective. The games and gaming events in the document were selected by Dr. Mata Haggis, Thomas Buijtenweg, and Will Davis (head of the IGAD game development programme at NHTV and formerly a game developer with major international studios). These people have been actively involved in games development and video game studies for a combined total of over 50 years. Outside of this core group, the choices were informed by discussions with industry representatives, researchers, and games developers such as Tanya Depass, Gordon Bellamy, Chris Wright, Rami Ismail, Mikkel Svendsen, Tuki Clavero, and many more. The selections were made on the criteria of significant trends that were either of great importance to

the past, present, and future of video game development in terms of social, cultural, and technological innovation (within the gaming community), or marked significant interactions with wider society. There are hundreds of thousands of games in existence, and so an additional criteria was applied that the games or events should be reasonably easy to research via public data sources so that they could be used as a starting point for further studies into games culture.

This approach uses games culture as a starting point for studying games, rather than beginning from formal academic studies. Like all studies of such large and high velocity fields, the selections are derived from industry knowledge and debates, and would likely provoke debate among game developers about a number of choices, but the goal was to provide angles of inquiry and stimulation for an interested non-players rather than an exhaustive analysis of all trends within games culture. Such a study would be notably flawed in its conception, and so a self-consciously partial survey has been created that covers broad trends and encourages further research. An outsider reading this document will afterwards be familiar with a large number of touchstones that many games developers in Europe would consider standard cultural knowledge.

This approach, of bringing 'insider' knowledge to a wider social readership, to demonstrate cultural complexity and debate, reflects Gaming Horizon's methodology and goal of expanding the critical debate to include games from outside the non-leisure games industry in the EU's evaluation of games as a culturally reflexive medium. As the project transitions from the analysis of the literature to the collection of primary data, the empirical focus will shift to "expert informants" - individuals whose perceptions, understandings and forms of localised knowledge can be systematically explored (Bogner, Littig, & Menz, 2009).

4.8.2. A practice-based perspective on the role of gaming in society

The entertainment games industry has a global impact on society, media, and the economy. This industry has an annual turnover of over €93bn and, like the film industry, has generated a variety of landmark creations that have significance for both mainstream and non-mainstream culture. These games, brands, technologies, and trends need to be understood as starting points for an assessment of the potential value of entertainment games for the European Union. The following article summarises some of

the key areas of cultural, social, or technological impact and innovation within the games industry and is subdivided into 14 sections. These sections are indicative of major areas of social interest and discussion, but there are many further topics that could be added.

4.8.2.1. Characters

Many of the characters of video games have widespread recognition outside of the gaming industry. Although this is particularly centred around the interests of children, their integration with daily life is making modern characters popular with adults too. 'A Q Score survey in the early nineties revealed that *Mario* was more recognisable to American children than Mickey Mouse.' [18] Also in the 1990s, *Lara Croft* became the first virtual character to feature on the front cover of a fashion magazine,[19] and then became the star of two live-action movies portrayed by Angelina Jolie. Besides these cultural hits, other game characters have transferred into wider social awareness, such as *Sonic the Hedgehog, Pac-Man, Pokemon, Minecraft,* and *Angry Birds*. Each of these brands has either begun with cross-generational appeal in their gameplay or has existed for long enough that the first players are now sharing the characters with their own children.

18 Stuart, K. (2010, September 13). *Super Mario Bros: 25 Mario facts for the 25th anniversary.* Retrieved February 01, 2017, from https://www.theguardian.com/technology/gamesblog/2010/sep/13/games-gameculture

19 The Face (1997, June) EMAP

Figure 14. Lara Croft game character on the cover of The Face magazine

4.8.2.2. Early arcade – 'pure games'

The earliest video games were limited by the technology and so had to focus on simple gameplay and narrative settings that were easy to convey. *Pong*[20] was released in 1972 and was the first commercially available video game. Previous games, such as *Spacewar!*,[21] did exist but were on privately owned computers or in research departments. In the following decade more games were released that set the template for many of the following releases, such as *Space Invaders*,[22] *Tetris* (Fig.15),[23] and *Missile Command*.[24] These games utilise simple mechanics and have a nominal amount of narrative content, the themes are usually competition or violent destruction, with only *Tetris* as an example of a purely abstract game. *Tetris* has been remade many times, but it is an example of a gameplay mechanic which is hard to refine any further because of the compelling gameplay loop (a cycle of actions which repeats in the game and provides player satisfaction). Variations of *Tetris* are still being developed and released,

20 Atari, *Pong* (1972) Atari Corporation, arcade

21 Russell, Steve, *Spacewar!* (1962) PDP-1

22 Taito, *Space Invaders* (1978) Taito, arcade

23 Pajitnov, Alexey, *Tetris* (1984) PC

24 Atari, *Missile Command* (1980) arcade

such as *Tricky Towers*,[25] but these are commonly seen as a deviations or spin-offs from a successful core, not an improvement of that core.

Figure 15. An early version of Tetris

4.8.2.3. Violence

Themes of violence and conflict have existed in game from their earliest forms, often combined with science-fiction or fantasy settings: as previously mentioned, *Spacewar!* was one of the first digital games to be created, and *Colossal Cave Adventure*[26] was an fantasy-themed game of combat and dungeon exploration as well as being the first multi-player online game. Violence continues to be a common theme in video games and has, to mainstream media, been most commonly associated with the games in the *Grand Theft Auto* (‘*GTA*’) series originally developed by Rockstar North (Dig.16).[27] This series has provided many news stories, some real and others that may have been artificially stimulating consumer interest,[28] but regardless of the veracity of the news reports the series has consistently featured options for violence against civilians of all backgrounds, from sex workers to corporate bosses. Alongside the *GTA* games, many other titles have come under media and public scrutiny for their portrayal of violence,

25 Weird Beard, *Tricky Towers* (2016), Windows PC/Xobx/PS4/Linux

26 Crowther, Will, *Colossal Cave Adventure* (1975) DEC PDP-10

27 Rockstar North, *Grand Theft Auto* (1997-current) Rockstar Games, multiplatform

28 gamesindustry.biz (2003, September 11). *Grand Theft Auto* in the dock over US road killing. Retrieved February 01, 2017, from http://www.theregister.co.uk/2003/09/11/grand_theft_auto/

particularly as games have been taking steps towards realism in their graphics. Such games include the early 3D science-fiction horror game *Doom*[29] and the snuff-movie themed stealth killing game *Manhunt*,[30] which was another game released by Rockstar North. These controversies have generally been considered to improve sales of the games in question, with the *GTA* series as one of the most profitable game brands in the world. The consistently high review scores it has gained suggest that the quality and complexity of *GTA*'s gameplay systems does appear to be important; by contrast, both *Postal*[31] and *Hatred*[32] are notoriously violent games with low review scores and mediocre sales.

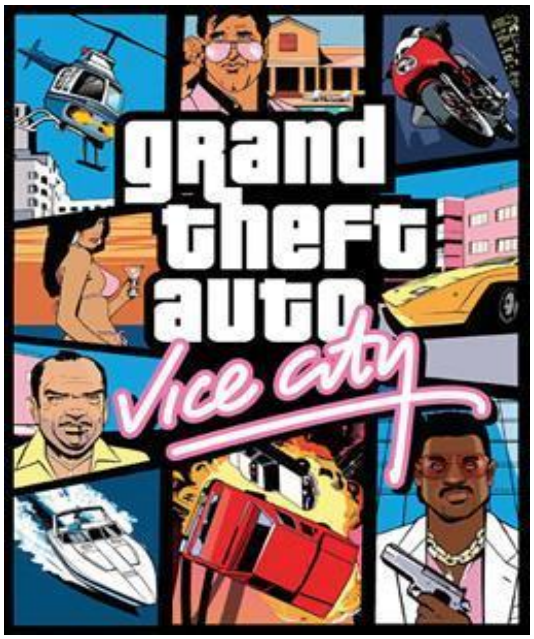

Figure 16. Game from the Grand Theft Auto series

4.8.2.4. Noticed by wider society

Video games have drawn attention from non-industry media in many ways. The violence of the *GTA* series drew significant attention and *Bully*,[33] also published by

29 Id Software, *Doom* (1993) GT Interactive, PC

30 Rockstar North, *Manhunt* (2003) Rockstar Games, PS2

31 Running With Scissors, *Postal* (1997) Ripcord Games, Windows PC

32 Destructive Creations, *Hatred* (2015) Destructive Creations, Windows PC

33 Rockstar Vancouver, *Bully* (2006) Rockstar Games, multiplatform

Rockstar Games (although developed at Rockstar Vancouver, not Rockstar North which typically leads the production of the *GTA* series), also drew intense media scrutiny over the idea that the player would be learning to bully other characters. Like many spates of media attention, it did not appear to matter that this representation of the game was not accurate.

Despite the negative attention, games have also been having more positive coverage, particularly in the last decade where developers have consciously expanded both the themes of the games and their target audiences. Nintendo's *Wii*[34] console was a huge success, with sales of over 100m units.[35] In particular the software and hardware combinations of *Wii Sports*[36] and *Wii Fit*[37] were mainstream breakthrough games that reached audiences that would not have classified themselves as 'gamers' (Fig.17). Arguably, this accessibility and gentle introduction to games may have contributed to the success of other publicly acceptable games such as Nintendo/Niantic's *Pokémon Go* (Fig.18),[38] King's puzzle game *Candy Crush Saga*[39] and Mojang's child-friendly *Minecraft*.[40] *Minecraft* in particular has managed to crossover towards being a platform for creation in itself, where works created in the *Minecraft* world have been exhibited in galleries, and the *Minecraft* game engine has been used for diverse purposes such as storytelling and teaching.

34 Nintendo, *Wii* (2006)

35 Nintendo, IR Information : Sales Data - Hardware and Software Sales Units. Retrieved February 02, 2017, from https://www.nintendo.co.jp/ir/en/sales/hard_soft/

36 Nintendo, *Wii Sports* (2006) Nintendo, Wii

37 Nintendo, *Wii Fit* (2007) Nintendo, Wii

38 Niantic, *Pokémon Go* (2016) Nintendo, mobile

39 King, *Candy Crush Saga* (2012) King, mobile/Linux/Windows PC

40 Mojang, *Minecraft* (2011) Mojang, multiplatform

Figure 17. Wii Fit game package for Nintendo's Wii platform

4.8.2.5. Technological and economic revolutions

The entertainment games sector has often been based on an evolutionary model rather than on revolutions; many games could be described as improvements or combinations of existing games or gameplay styles. However, some games and related industry developments have been leaps forward for the industry. For example, *Super Mario 64*[41] was not wholly the first game to feature a player-controlled character in a 3D environment, but it was the first to make this feel enjoyable and responsive. Like *Tetris*, *Super Mario 64* took simple elements and refined them in a way that still holds strong appeal over twenty years later:

"Mario 64 is a game built on first principles. What Mario embodies, and the reason he has always been so compelling to control, is a set of universal laws: mass, momentum, and inertia. But Nintendo's designers are even smarter than this. Among Super Mario Bros' many innovations was the genius touch of building up speed, and this speed affecting your jumps - a piece of 'realistic' physics that is then added to by the 'unrealistic' ability to control the character in mid-air. Mario has always meant perpetual

41 Nintendo, *Super Mario 64* (1996) Nintendo, Nintendo 64

motion, but his creator also likes to bend the rules so this never becomes a drag."[42]

In the same year, Tomb Raider would take a different approach to 3D adventure by adding guns and sexual appeal to the explorative gameplay, but *Super Mario 64* was unique in the finely honed sense of motion experienced by players.

Figure 18. Screenshot from the Pokémon Go augmented reality game

Nintendo have consistently been looking for new markets outside of the stereotypes of teenage male gamers. The *Mario* series has always held broad appeal, and the *Wii* as a game system brought video games to a new audience, Nintendo's Gameboy (1989) was an innovative multi-game portable gaming system which was packaged with *Tetris*, and in 2016 Nintendo released *Pokémon Go*, which introduced augmented reality to many players for the first time. Augmented reality combines real-world locations and structures with virtual game-world events or graphics, for example by using a smartphone's camera to show, to the player, a virtual monster running around in a real-world park. The player points their phone into the park and a new 'layer' of virtual life is added to what the phone's camera sees. Like with *Super Mario 64*,

42 Stanton, R. (2015, December 04). *What made Super Mario 64 so special?* Retrieved February 07, 2017, from http://www.eurogamer.net/articles/2015-04-12-what-made-super-mario-64-so-special

Nintendo are not the first to use these ideas, but they are the first to bring them mainstream appeal and recognition.

Equally revolutionary are technologies that have not had such mainstream attention. Apple's App Store launched in 2008 and by 2014 it was reported that 'games deliver the vast majority of Apple's revenue from the App Store, accounting for an estimated 75% of income'.[43] The transition to downloadable content and platforms was soon adopted by Valve with their 'Steam' platform, which currently dominates the online retail market for PC and iOS games, and for Microsoft and Sony to release their own home console versions with Xbox Live Arcade (XBLA) and PlayStation Network (PSN). This transfer to digital marketplaces has created many new business models which step away from the previously traditional 'premium' one-off game purchase. One of these is so-called free-to-play (or 'F2P'), whereby the main game is given away for free but features adverts or charges for additional content in order to generate revenue. This has led to controversy among developers, where some developers argue that platform holders such as Apple are exploiting game developers with business models that are unsustainable in the long term.

Another significant change for game development technology was the release of the '*Unity 3D*' game development tools and 'engine'. A game engine is a piece of generic software that runs a game and which handles many of the basic processes of game development so that game developers can focus on the more creative and unique aspects of their game. Like many revolutions, it was not the first freely available game development tool, but it was the first to combine near-professional power, and complexity in a free version that retains the vast majority of full-version features. It had largely unchallenged control of the free game-engine market until *Unreal Engine 4* became both free to use and user friendly in 2015, and Amazon entered the same market in 2016 with their Lumberyard game engine. *Unity 3D* triggered a huge surge of games development in small studios, for whom games development was affordable and approachable for the first time. This surge of small studios, often referred to as 'indie'

43 Mirani, L. (2014, December 10). Apple is overwhelmingly reliant on games for App Store revenue. Retrieved February 07, 2017, from https://qz.com/309715/apple-is-overwhelmingly-reliant-on-games-for-app-store-revenue/

developers, is tied to both the economic and technological evolution of games, but also triggered a revolution in terms of themes and content.

4.8.2.6. Competitive gaming

Competition has been a feature of games from the very earliest examples. *Space War!*, *Pong*, and the first ever entertainment-focused video game *Tennis For Two*[44] all are games where two players compete to win the game. This characteristic was partially the result of the limited processing power available at that time; competition with a Non Playing Character (NPC) driven by Artificial Intelligence (AI) was not yet feasible due to computational limitations, so the adopted design solution was competition between two human players. This restriction was lifted in the 1970s and in the 1990s games such as *Doom*, *Quake*, and *Counterstrike* all became successful examples of games where competition was a key part of their appeal (Fig.19).

Competitive gaming is a key feature of 'eSports'. Individuals and teams can play to represent themselves or even their countries in stadiums filled with fans as if they were attending a traditional sports event. League of Legends is the most notable current example of a successful game in this genre, but many other games have had considerable success in this field, such as *Defence Of The Ancients* (more commonly referred to as *DOTA*), the *Street Fighter* series, and *World of Warcraft*.

Figure 19. Competitive gaming tournament

44 Higginbotham, William, *Tennis For Two* (1958), Analogue computer

Aside from the stadium-filling competitive gaming titles, games such as *Pokémon*, or the *FIFA* and *PES* football game series have had competition with friends as a core part of their appeal.

Multiplayer is also a common element even in games that are best known for their single-player gameplay, such as the *Uncharted* series. These games face an economic challenge that means that, after the main game has been finished, players may choose to sell the game. When that game is purchased by another player it will not generate any revenue for the publisher or developers, only the second-hand retailer. Adding competitive multiplayer modes of gameplay means that games may stay out of the second-hand system for longer and so are more likely to be purchased first-hand, increasing revenue for the makers.

4.8.2.7. Brands

There are several brands which are highly associated with games development and have reached mainstream, non-gaming audiences. Atari is likely to have been the first game developer that many would have heard of in the 1980s. As a mark of their success, their logo can be seen in the futuristic world of Blade Runner (Fig. 20). Atari lost its position as a leader in games, but the brand remains synonymous with the entertainment video game industry and, after many financial difficulties and transfers, it does still operate as a games publisher. Likewise, Sega were a major force in games development in the 1990s but now are a much smaller publisher after financial difficulties brought on by misjudging the readiness of technology for the market. Nintendo's *NES* was released in 1983 and after four decades they have maintained relevance to modern players. Their strategy of innovation has seen them move out of step with their audiences at times. The company's stability has been threatened by some serious technological misjudgements, such as the *VirtualBoy* (which promised VR and greatly under-delivered) and the under-powering of their machines in comparison to other console makers. However, Nintendo's focus on core gameplay and often family-friendly titles has allowed them to retain market viability.

Figure 20. Still from the film Blade Runner

In 2017, the games branding market leaders are Microsoft with their Xbox series of consoles, which particularly dominate in the US and to a lesser extent in the UK, and Sony's PlayStation consoles, which are generally more successful in wider Europe, the eastern markets, and Australia and New Zealand.

Other, non-gaming brands also have associations with games development, such as the FIFA football league, NFL in America, or Red Bull which experimented with product placement in games as advertising in the late 1990s and sponsors eSports gaming events today.

4.8.2.8. Sexism

Video games have a long history of being perceived as aimed at teenage boys. Part of this stems from their representation of men and women in ways that are often shallow or immature. *Lara Croft* is an emblem of this: in her early video games she was modelled with a thin waist, large breasts, and revealing or skin-tight clothing. Her cultural impact was complex: she was an innovative leading woman who was often framed outside of masculine control in her stories, but the marketing of the games was heavily sexualised and conformed to patriarchal stereotypes of desirable femininity.

This tension between a character that is both strong/independent and also heavily sexualised fits into many of the debates regarding second wave feminism in the 1980s and 1990s. There was a need to find new modes of representation for women in media, but many attempts at finding strong roles for women were cast back into

sexualised models of femininity that did little to challenge societal roles of women as subjects of a male gaze.

Figure 21. Screenshot from the game Dead or Alive Xtreme Beach Volleyball

This tension is so endemic in video games that it is challenging to find stand-out examples because the level is so consistently low. This reflects trends in television and film too, where sexism is deeply entrenched as an accepted norm of writing and casting; however, in mainstream entertainment games, examples such as the *Dead or Alive* series and the *GTA* series do stand out (Fig.21). The *Dead or Alive* games commonly feature young slim women fighting while wearing bikinis. There are modes in the game where there is no traditional gameplay but instead the player can rotate the viewing camera around and closer to the bodies of the characters in a mode that is self-consciously voyeuristic. The *Dead or Alive* series is deliberately made with a softcore pornographic sensibility, but the *GTA* series offers a reality which can be either darkly satirical or wholly misogynistic depending on the critical stance. The *GTA* games often feature women who are shrewish, gold-digging, or disposable, and is particularly notable for the potential violence against sex workers, a group who face extreme violence and societal prejudice on a daily basis in the real world.

Although discussion of sexism in games is largely centred on their representation of women, it should also be noted that their representation of men is not substantially more nuanced. Although there is significantly greater breadth of body type, age, and physical attractiveness in the male characters, the majority do fit into a stereotype of a young, conventionally attractive man that proceeds to solve gameplay challenges through the use of (sometimes excessive) violence. This continual portrayal

of physical excellence and of violence as men's primary approach to interaction with the world does little to allow greater maturity in their characters or in player's ideas about masculinity. However, the male characters are, in the greatest majority, active participants in their stories, which is a significant difference from how women have historically been represented in games.

Outside of the content of games, sexism has been a consistent presence in many parts of the gaming community, particularly in online communities but also at conferences/festivals. Online harassment of women is a subject of importance to all media and has received particular attention within gaming, especially in the wake of the 'GamerGate' harassment campaign that largely targeted women, transgender people, and minorities or their allies. This movement, closely related to white supremacist and nationalist movements that brand themselves as 'alt-right', has appeared in many aspects of modern culture and games are no exception.

4.8.2.9. Racism

Like sexism, racism in games reflects wider social trends. The financial inequality that hits many people of colour, and particularly people who are black, has led to a lower access to technology or educational/training resources than for people who are white. When this is combined with the geographic areas where most video games are developed (Europe, America, the Far East) the results are very low numbers of people who are black making video games, and few black characters in the games themselves. When black men are featured in games, their presence is frequently stereotypical (Fig.22):

> *outside of sports games, the representation of African Americans drops precipitously, with many of the remaining featured as gangsters and street people in Grand Theft Auto and 50 Cent Bulletproof. (Williams et al., 2009)*

This imbalance is also present in fantasy, science-fiction, and other genres of games that are not set in the real world. For example, there are no people of colour in the game *Witcher III*. It is set in a fantasy variation of medieval Poland, where many mythical creatures exist but people of colour do not, even though there is sufficient evidence that the creatures never existed there but people who were not white definitely were in the country at the time. Also like sexism, this kind of passive racism is common

and presumably unintentional, where the presence of people of colour appears to be an after-thought and is eclipsed by the white protagonist. Excessive and directed racism are rare in games' content, but equally so are starring roles for people of colour.

Figure 22. African-American characters from the Grand Theft Auto series

This situation is changing and racism in games content, development, and culture is a topic that has received increasing attention in recent years. Although it is still rarely an explicit theme, it was a major element of *Mafia III*: 'This is a game about how a person of colour destroys white supremacy.'[45] The inclusion of direct and obvious discussion of racism in *Mafia III* shows that a major developer feels comfortable enough to invest millions of dollars in creating a game that includes this theme. It is not likely that this title alone will revolutionise games, and there are many games that will continue to feature implicit racist tendencies (reflecting wider culture's lack of rapid change), but *Mafia III* can be read as a sign of slowly increasing maturity in the games industry towards issues of race, ethnicity, and society.

4.8.2.10. Sexuality and sex

Given the strong presence of highly sexualised characters in video games, it might seem logical that sexuality and sex (where sexualisation leads to relationships, expressions of gender preference, or sexual acts) are also common in games, but this is not the case.

45 Moosa, T. (2016, October 20). *Mafia III* is just a game, but it shines a spotlight on the reality of racism. Retrieved February 07, 2017, from https://www.theguardian.com/commentisfree/2016/oct/20/mafia-iii-videogame-racism

While games will regularly present active and dominant muscular men and sexualised women, it is highly unusual for the characters to act in ways that suggest a more meaningful interaction than a rescue scenario with perhaps a chaste kiss. The root causes of this could be subject to extensive studies, but the result is that many game-world relationships are purely functional and never seen to be consummated.

Games that have attempted more than simple relationships have often been controversial. Again, the *GTA* series provides a well-known example. Although it was cut from the final game, hackers discovered a mini-game (a small and typically simple game within the larger game) remained in the code of *Grand Theft Auto*: San Andreas.[46] By changing some of the code of the game, the hackers reinstated the sex-game sequence and allow the lead character to have sex with his girlfriend. This modification (referred to as a 'mod') provoked controversy in the mainstream media and the game had its certification changed in America to 'Adults Only'. This was based on content that was only accessible through using the software in a way that was unintended by the development studio, and provokes a wider debate about the responsibility of developers for the use of their software after release.

The sex mini-game in *GTA* was not intended for public consumption, but in *Mass Effect* the player spends many hours saving the galaxy and, optionally, building a relationship with one of their ship-mates. This crew member may be human or alien, male, female, or not conventionally binary gendered. The game was rated for mature players, and the sex sequence was no more explicit than could be seen in a typical love-scene from many action or science-fiction movies, but nonetheless it provoked a strong reaction from Fox News in America. This controversy may reflect a general and mistaken impression that video games are all aimed at children, when the realities of the current market suggest that the average player is in their 30s, or it may be linked to an impression that children will be playing all video games without parental knowledge.

The developer of *Mass Effect*, Bioware, has been a leader in making mature relationships part of their games. They have been particularly open about including relationships outside of heteronormative models, frequently driven by their writing teams and fans who are very vocal about wanting more meaningful relationships in their

46 Rockstar North, *Grand Theft Auto*: San Andreas (2004) Rockstar Games, multiplatform

games. Conferences such as GaymerX have emerged in the last decade that highlight the increased presence and voice of Queer communities in video game development and particularly in the player communities. Games such as *Mass Effect* and *Dragon Age: Inquisition* attempt to push the boundaries of how relationships can complement gameplay scenarios.

Figure 23. Image from Tracer Reflections, the official Overwatch comic

As a demonstration of the influence of having game characters that are both sexy and nuanced, Blizzard's game *Overwatch* has had an unusual success by becoming the 11th most searched for term on Pornhub, one of the internet's most successful pornography download websites.[47] In Brazil and Russia, 'Overwatch' was the most searched for term, coming above more typical search terms such as 'lesbian' or 'teen'. The game features a highly diverse range of characters with different races, ethnicities, and body types represented in a light-hearted manner and complimented by game mechanics which strive to encourage positive social interactions among players. As an additional point of diversity, the figurehead for the game, a character called 'Tracer', was revealed in the official game comic to be in a lesbian relationship.[48] That

47 Pornhub. (2017, February 02). *Pornhub*'s 2016 Year in Review. Retrieved February 07, 2017, from http://www.pornhub.com/insights/2016-year-in-review

48 Chu, M., Monillō, M. (2016, December 23). *Overwatch*: Reflections Retrieved February 07, 2017, from http://comic.playoverwatch.com/en-us/tracer-reflections

Overwatch has combined strong gameplay and such widespread presence in sexual media shows that games are growing to become a more powerful medium for portraying sex and sexuality, but there is no doubt that such examples are rare at the moment (Fig.23).

4.8.2.11. 'Art games'

As previously mentioned, the increasing availability of powerful games development tools and engines has meant that many games are often made by small teams or individuals without large production budgets. These independent developers (referred to as 'indies' or 'indie teams') have lower production costs but also operate in a crowded market. As a result, they are more inclined to take artistic risks than larger development studios would be. These risks may be taken to satisfy an expressive need of the creator/s, and sometimes they are taken to stand out against the competition.

Figure 24. Screenshot from the game Braid

Notable examples of artistic games are *Braid* (Fig.24), *Dear Esther*, and *Journey*. *Braid* was developed largely by one creator over several years and features a combination of '2D platformer' gameplay (a side-view *Super Mario Brothers*-esque game, where the player jumps between platforms and can only move in the horizontal and vertical planes) and unusual time control mechanics. It had a theme that was possibly about relationships or possibly about nuclear weapons, and this ambiguity was part of the appeal beyond the strong platform-puzzle gameplay.

Dear Esther was originally an experiment in game narrative produced by Dr. Dan Pinchbeck that was later given improved graphics and a commercial release by Valve Software. The game features no interaction beyond walking across an island and listening to a sequence of sections from a letter written to a woman called Esther. The game challenges many of the preconceived ideas about what constitutes a game and has inspired many creators to experiment with reducing interaction options to focus on storytelling.

Journey appears at first glance to be more classically a video game than *Dear Esther*, in that it has multiplayer and jumping over platforms in a mysterious world to reach a goal, but like *Dear Esther* it has stripped away many elements that typically feature in video games: there is no game-stopping failure state, and players cannot communicate through any typical in-game system. The journey of the title takes on a mystical meaning as players progress through the game-world, and the game effectively makes players bond with another anonymous player in a way that many have felt was deeply personal and very moving.

These games construct emotional journeys by playing with game mechanics but others are using a combination of gameplay and the traditional medium of the written word to create new gameplay experiences. Interactive Fiction (IF), namely the combination of traditional linear narrative with reader choice and additional media, is being used to create engaging variations on traditional novels. *Depression Quest* (Fig.25) is an exploration of how depression can limit your choices in life and uses a simple device of greying-out choices that the player cannot make because the mental state of the in-game character is not sufficiently positive. *Queers In Love At The End Of The World* is a game that only lasts ten seconds but can be played multiple times. The player can choose multiple actions to perform with the person they love in the game, but the game will invariably end after 10 seconds. This provokes an unusual conflict between wishing to read every word on the screen, rushing to see everything in the time frame, and the strange enormity of the meaning of the small choices.

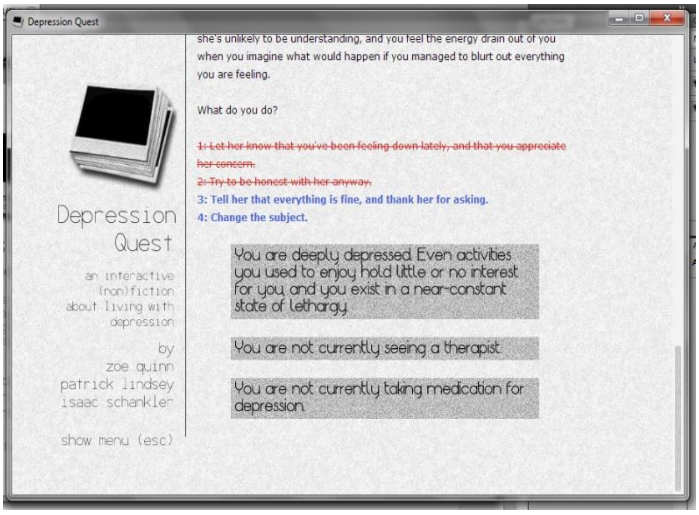

Figure 25. Screenshot from the game Depression Quest

Although the market for such artistic games is highly variable and return on investment is uncertain, this area seems set to expand as more creators look for ways in which audience choice changes the nature of the relationship between the creator, the work, and the viewer.

4.8.2.12. Time investment

Whereas the main audience for video games was once the dedicated group of fans seeking out new titles and information about their hobby, the demographics of games consumption have shifted over the past decade. Game playing is now a feature of the lives of many people, particularly those who are younger and have grown up with games, but also older players in their 40s, 50s, 60s, or more who may be drawn to the appeal of engaging in an interactive hobby that is arguably more involving than passively watching television. This shift in demographics, and the increasing acceptability of video games as an entertainment option for adults, means that they can no longer assume that "gaming", in the conventional sense of the word, is the priority of the players. In this regard, video game developers are no longer only competing with each other for the attention of a dedicated fan base, but instead are now competing with all entertainment media, including television, YouTube, books, theatre, sports, and more.

Figure 26. The online Zynga game Farmville

Part of this shift was initiated by Apple's App Store and the wider introduction of smartphones, which meant that games could be fitted into convenient dull moments of the day, but also platforms such as Facebook meant that older players who were using social media to communicate with friends and family would be able to play games with those same people in games such as *Farmville* (Fig.26). The common element here is that the technology platforms for playing games were introduced through existing devices that the new players already owned, i.e. smartphones or Facebook accounts, and through these gaming became an extension of their everyday activities.

This competition has had a fundamental impact on game development strategies. Games were once designed to be highly engrossing for the duration of their run-time, and ideally to make the player desire to buy a sequel, but now games can be designed with many different time investment requirements. Some games aim to be extremely long, requiring dozens or hundreds of hours of play to fully explore them, such as the *Dragon Age*, *Skyrim*, or *Fallout* series. Other games are designed to be played in very short bursts and sometimes deliberately limit the amount of time that they can be played each day, such as *Dr. Kawashima's Brain Training*, *Farmville*, *Angry Birds*, or *Candy Crush Saga*. Other games, such as *Destiny*, *EVE Online*, *Left 4 Dead*, or *World of Warcraft*, are designed to be nearly infinite in their play time or replayability, and frequently base their appeal on community events or competition. It is notable that the games that require extended play trend towards themes that conform to the stereotypes of video games: fantasy, science-fiction, or supernatural horror.

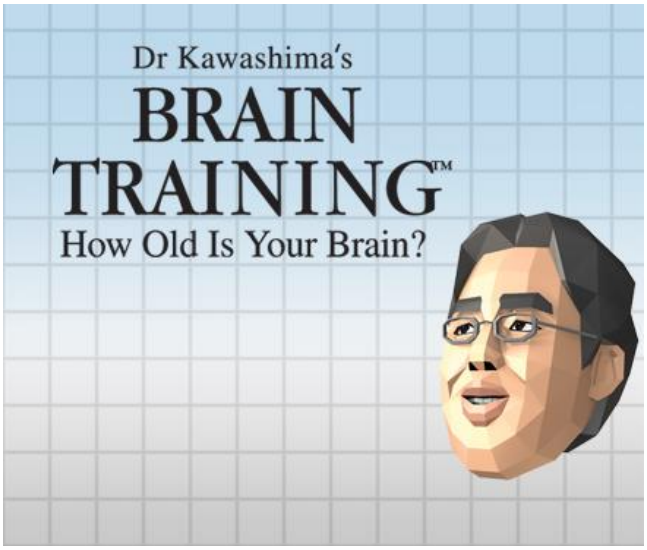

Figure 27. The Nintendo game Dr. Kawashima Brain training: How Old Is Your Brain?

This segmentation by time investment is rarely discussed among game developers or studied by researchers, but is present implicitly in many discussions at industry conferences, usually under the title of 'casual' and 'hardcore' gaming; however, there is considerable disagreement about the meaning of these terms. A hardcore gamer is traditionally considered to be a person who plays games for many hours and reaches a high level of experience or expertise in that game, while casual players are usually described as people who engage in short play sessions and who would not self-identify as 'a gamer', but these divisions are frequently highly flawed: *Farmville* is considered by many game developers to be a quintessential casual game, requiring little skill and short play sessions, but many players have invested hundreds of hours into the game and its systems when those short sessions are combined. This highlights the current insufficiency of player and game categorisation, because it may be that such online and multiplayer experiences should be given a more nuanced classification to aid meaningful discussion.

Traditional game industry notions of AAA (pronounced 'triple A' and meaning a game that has high-quality Art Audio and Animation) and indie developers have become increasingly blurred. The AAA industry was once roughly delineated by the production of high-quality and high-time-investment games, and indies were viewed as producing small, short or short play-session games that may be more reflective of a hobbyist level

of skill in the developers; however, the huge success of games such as *Angry Birds* and *Candy Crush Saga* has weakened this boundary. Some developers, such as Ubisoft, are shifting away from the AAA label and are increasingly describing themselves as 'high-end' developers who produce games in which the level of polish in the experience is more important than the time-investment required from players. These changes are happening during the GH project and will continue to transform the game development industry in future years.

4.8.2.13. Commerce and economics

The changes in player time investment are making a significant impact on the business models of video games. Large, traditional gaming Intellectual Properties (IPs) continue to exist and make billions of euros in profit using the 'premium' model of a main single purchase of the bulk of gameplay and/or storyline. Examples that use the premium model are the *GTA* series, *FIFA*, and Assassin's Creed, but online play and new business models are changing the way that IPs are sold. *World of Warcraft* and *League of Legends* are two games that are free to play in their basic state, allowing many hours of play without the customer paying any money at all. Instead of a traditional boxed product*, World of Warcraft* and *League of Legends* both use new business models such as 'freemium' and 'microtransactions' to make profit from their games.

Figure 28. Financial growth of the global games market

Freemium is a system in which the basic product is provided free of charge but additional or advanced features need to be paid for if the customer wishes to use them. Microtransactions are small costs that may be charged for in-game purchase of

additional elements like clothing for an in-game character, in-game currency to spend, or ammo for an in-game weapon. Microtransactions are typically very small amounts but can quickly mount up to become large sums if a player uses them regularly. These sums can amount to significantly more than the typical cost of buying a boxed game, but the payments may be spread over many play sessions, reflecting the longer time investment that these games require. These models have an advantage that if the game is pirated, i.e. downloaded from an illegitimate source, the developer still gains revenue. As previously mentioned in the section on competitive gaming, the second-hand market is, like piracy, another financial threat to the premium revenue model, so many of the premium games also feature downloadable content (DLC) which allows the player to play new stories or have new content added to the core game. DLC operates in a manner similar to microtransactions, but the payments are typically larger and for more substantial additions to the game experience. These new business models are both a response to customer needs and a necessary adaptation to the changing economic and technological contexts of game development and marketing.

These systems require online access for the transactions to work. Apple's App Store, Google's Play Store, Valve's Steam, Microsoft's XBLA, and Sony's PlayStation Network are essential elements in supporting the growth in these revenue models. The profits that can be made from a successful game using these models are very large: *Candy Crush Saga* was reported to be making $850,000 per day in 2013[49] and it may have peaked over $1m per day before lowering to its current estimated $500,000 per day revenue. *Clash of Clans* maker Supercell reported $2.3bn income and $930m in profit in 2015.[50] Without the new online games distribution processes these games would not be able to function.

49 Boone, J. (2013, September 03). Candy Crush Makes $850,000 Per Day! Admit It: How Much Have You Spent on the Game? Retrieved February 08, 2017, from http://www.eonline.com/news/454970/candy-crush-makes-almost-a-million-dollars-per-day-admit-it-how-much-have-you-spent-on-the-game

50 Poladian, C. (2016, March 09). *'Clash Of Clans'* Maker Supercell Posts $2.3B In Revenue, $930M In Profit For 2015 As Growth Slows. Retrieved February 08, 2017, from http://www.ibtimes.com/clash-clans-maker-supercell-posts-23b-revenue-930m-profit-2015-growth-slows-2333237

Beside these direct monetisation strategies, many game developers are using advertising to support their games. Product placement has been a feature of games since the 1990s with *Zool*[51] and *James Pond 2*[52] being early examples, but 'branded entertainment' (games made specifically to advertise a brand) and 'dynamic advertising' (adverts updated via the internet and potentially based on user context such as geographical location) are more common in modern media. Smartphone game developers will frequently use advertising banners on the borders of their games as a way of gaining revenue every time a person plays their game. Developers have begun to use full-screen adverts between levels in their games to increase income, and some games let players choose between waiting for a period of real-world time, paying a microtransaction, or watching a video advert to continue playing. Where games use adverts in these ways, it is common for the developer to also allow the player to purchase an advert-free version of the game for a few euros. Although the money generated by each view of an advert may be less than one cent, if the game is popular and playing hundreds of thousands of times each day then the revenue can quickly accumulate into a reasonable income.

These changes in business models are recent and ongoing. It is unknown whether games will continue to be funded using these models or whether new systems will develop to replace or compliment them. Threats from piracy and second-hand sales push developers to innovate, but the large audiences that can be reached with different strategies pulls developers towards change too.

4.8.2.14. Acknowledged educational content in commercial entertainment games - 'game based learning'

Games that are focused on entertainment are increasingly being recognised for their potential application in education and professional development. James Gee has been a notable proponent of this:

> *Ironically, just as what you learn when you learn to play a good video game is how to play the game, so too, what you learn when you learn biology should be how to play that game. However, for both video games and biology, it's not a*

51 Gremlin Interactive, *Zool* (1992) Gremlin Interactive, multiplatform

52 Millennium Interactive, *James Pond 2* (1991) Millennium Interactive, multiplatform

> *case of "anything goes"—this is not a permissive "progressivism" writ large. You have to inhabit the identity the game offers (be it Battle Mage or field biologist) and you have to play by the rules. You have to discover what the rules are and how they can best be leveraged to accomplish goals. Perhaps the word "game" rankles—some use "simulation" instead. However, keep in mind that a game like Full Spectrum Warrior is a game when I buy it off the rack, but serious learning when a soldier "plays" the professional training version. (Gee, 2007)*

The educational benefits of serious and applied games (games for learning and games for behavioural change) have been studied extensively, but the educational benefits of games that are designed primarily for entertainment have been considerably neglected in comparison. Some notable games do exist in this area, such as *Minecraft* and *Sim City*, but many games can be considered to have positive outcomes for mental acuity, puzzle solving abilities, observational skills and more. As stated by Elizabeth Zelinski and Ricardo Reyes:

There is great potential for digital action games originally developed for the entertainment of young adults to produce cognitive benefits in older adults. At this time, however, very little is known about the efficacy of digital games and whether they produce improvements greater than those of other types of interventions for older adults that will transfer to untrained cognitive tasks. (Zelinski & Reyes, 2009)

Figure 29. Screenshot from the game Fragments of Him

This lack of research into entertainment games restricts our knowledge in this area, and the benefits of competing genres of games for personal wellbeing are significantly under-studied. It may be that action games such as *Call Of Duty* are more beneficial than a *Tetris*-like puzzle game for some people, or that artistic and storytelling titles such as *Fragments Of Him* build pro-social empathic behaviour (Fig.29). Such hypotheses are viable, but without investment into research of entertainment products this area is currently lacking sufficient depth and breadth of information.

5. Conclusions

This deliverable brings together the results of the first two scientific tasks of the GH project, the methodological framework and the literature review.

The methodological framework comprises the multidimensional space where the project activities will be carried out and the project results will be positioned, as well as the methods adopted to collect and analyse the data. The dimensions of the methodological framework are the different perspectives on games and gamification (academic and practice based), the stakeholders addressed by the project (developers, educators, researchers, users, policy makers), and the game categories under analysis in GH (basically, all games provided that they have a digital component).

The literature review has been carried out with these dimensions in mind. The approach adopted for the three main academic perspectives (educational, psychological, and ethical) was based on a systematic analysis of academic literature, with special focus on a core of literature reviews and meta-analyses. A substantially different approach was adopted for the practice-based disciplinary perspective. Here, selective mapping of seminal games was performed, with discussion of the cultural, social, and technological impact they have had - and continue to have – within the gaming industry.

The implicit and explicit recommendations that emerge from this work address GH stakeholder groups to different extents: most address developers, educators, and researchers, while fewer recommendations have emerged concerning users and policy makers. The recommendations addressing developers mostly concern game design issues, such as guidelines for ethical game development. Those for educators regard aspects like criteria for game choice and pedagogical use, or the affordances and criticalities of gamification. Researcher-oriented recommendations largely concern indications about areas and issues for further research.

A bird’s eye view of the landscape emerging from this review reveals that, within the educational perspective, research on serious games and games for learning has been very prolific in terms of the number of studies but also the objects of study, so much so that it was difficult to define a general picture of research trends in the educational area. The messiness of this panorama can be seen as a result per se. We therefore acknowledged this scattered picture and resorted to analysis of the extant

literature in terms of disciplines involved, types of games, and learning impact, the three viewpoints most frequently adopted in the analysed literature. As far as the psychological perspective is concerned, research was mostly dedicated to a number of themes: motivation, engagement and flow in gaming; immersion and virtual reality; adolescents and internet gaming disorder, as well as internet addiction; the cognitive benefits of gaming; physical benefits for the rehabilitation of older adults; video games and health. Similarly, the ethical perspective revolves around topics such as violent games and their presumed effects on aggression (by far the most thoroughly investigated topic, and on the borderline with psychological research); identity and social inclusion (comprising gender and race issues, special needs, sexual identity); and game monetisation, as well as value-sensitive game design. Finally, the practice-based sociocultural and artistic perspective discusses a selected number of seminal video games that have made history in this industry, thanks to their innovative nature in terms of their relations to the market, their technological features and their political and cultural positioning in the gaming world.

In spite of this wealth of studies, few definite answers emerge, not even in the most heavily investigated areas. For example, the question as to whether violent games increase aggressive behaviour is explored in many studies and several meta-analyses but with contrasting results, possibly due to different assumptions and inclusion criteria. Similarly, until fairly recently, meta-analytic studies into the educational effectiveness of games and gamification were quite tentative in their findings, but those in more recent times have produced more positive results. Positive effects of games on learning, motivation, and engagement seem to depend significantly on a number of moderating variables, such as instructional context, support provided by educators, learners' characteristics, and time devoted to play. Furthermore, the features of the games matter significantly. This leads several authors to recommend careful planning of the introduction of games in formal learning contexts, mindful choice of games with aims and mechanics aligned with the desired learning outcomes, and consideration for users' characteristics, preferences and learning styles.

Although games and gamification are clearly distinguished concepts, research in these two areas does share some common concerns. Chief among these is the challenge to gain a better grasp of how suitable and effective particular (types of) game mechanics

may be. This could involve studying the impact of their introduction - into game/non-game contexts - in isolation and/or in comparison with other mechanics/features. The need for this type of research has been advocated by several authors. Gamification, based as it is on the selective application of such mechanics to an (existing) activity structure in a non-game context, lends itself particularly well to such atomic-level investigation. However, before seeking to apply any results beyond gamification, practitioners and researchers alike would obviously need to take account of the peculiarities that distinguish gamification from gaming. One of these is that participation in gamified activities is usually less spontaneous or voluntary than in gaming, as they are often proposed as part of learning or training activities. It should also be acknowledged that the range of mechanics typically applied in gamification is much narrower than in game contexts, which also limits the scope for generalisation.

This review has two main limitations, mostly due to the need to achieve a trade-off between comprehensiveness and time limitations. Firstly, the focus on literature reviews and meta-analyses limited the depth of analysis, although it let us maximise the breadth of the study. Secondly, in order to ensure an adequate coverage of research topics, it proved necessary to supplement this core of cited reviews and meta-analyses with other studies mostly drawn from the initial search and subsequent filtering procedure. The end result of these steps may have generated some bias in results. In spite of these limitations, we feel that the panorama provided, including the practice-base section, gives a reasonably accurate picture of the present state of knowledge in the field.

The methodological framework adopted as a basis for our work is broad enough to cover all relevant aspects but is – deliberately – rather schematic. The reality is not always so neatly defined. For example, the borders between the perspectives are not clear-cut: some topics like violence and aggression stretch across the psychological and ethical perspectives, while the cognitive and affective impact of games could have been ascribed to both the educational and the psychological perspectives. Similarly, the range of stakeholders potentially interested in the results of the GH project is probably not exhaustive. For example, some results are relevant to health professionals, a group that isn’t explicitly mentioned in our methodological framework. Nevertheless, the framework has so far proved useful for understanding the degree to which the literature

review has encompassed (a) the relevant sources of information, (b) the most significant perspectives identified, (c) the project stakeholders addressed, and (d) the different game categories.

In the continuation of the GH landscape analysis, we might find knowledge gaps or issues that are difficult to decipher. Further project activities, especially those belonging to the first phase, namely "Informed challenge through landscape analysis", will therefore strive to complement the present landscape by involving the project stakeholders as sources of information with increasingly participatory methods, through consolidated approaches of qualitative research. The under investigated areas and the hottest topics that this review has revealed will be thoroughly scrutinized, based on experts' involvement. The distance between academic and practice-based visions of gaming and gamification certainly deserves further attention, in the effort to make professionals more aware of research results and to help researchers become more sensitive to 'real world' concerns and needs. In addition, other stakeholders may also be involved in the GH discourse. This is precisely the way GH intends to challenge the extant vision on games and gamification in society and to build, through interactions with experts, an alternative framing for this important field of work.

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7. Appendices

7.1. Games related terminology as defined and cited in the analysed literature

Games

- organized play that is structured by a set of rules and an obstacle-tackling goal – (Ke, 2016)
- a voluntary activity structured by rules, with a defined outcome (e.g., winning/losing) or other quantifiable feedback (e.g., points) that facilitates reliable comparisons of in-player performances" – (M. F. Young et al., 2012, p. 63)
- a human practice bounded by rules, requiring some human input, and with variable outcomes related to the inputs (such as, but not limited to, "win" / "lose" conditions) - (Schrier & Gibson, 2010)
- All games share four defining traits: a goal, rules, a feedback system, and voluntary participation. – (McGonigal, 2011)
- gaming and games – in contrast to playing and toys – are characterized by explicit rule systems and the competition or strife of actors in those systems towards discrete goals or outcomes – (Salen & Zimmerman, 2004)
- computer games [are] interactive (Prensky, 2001; Vogel et al., 2006), based on a set of agreed rules and constraints (Garris et al., 2002), and directed toward a clear goal that is often set by a challenge (Malone, 1981). In addition, games constantly provide feedback, either as a score or as changes in the game world, to enable players to monitor their progress toward the goal (Prensky, 2001) – (Wouters et al., 2013)

Gaming

- gaming constitutes the sum total of activities, literacies, knowledge, and

practices activated in and around any instance of a game. Gaming is play across media, time, social spaces, and networks of meaning; it includes engagement with digital FAQs (or Frequently Asked Questions), paper game guides, parents and siblings, the history of games, other players, as well as the games themselves – (Klopfer et al., 2009)

- ludus (or "gaming") captures playing structured by rules and competitive strife toward goals – (Salen & Zimmerman, 2004)

Gamefulness

- "gamefulness" denotes the qualities of gaming (ludus) – (Deterding, Dixon, et al., 2011)

Gameplay

- the construct of gameplay [has] two main components - game mechanics (i.e. gameplay rules and actions) and the game narrative (i.e., game-world design, comprising scenarios, the storyline, and/or characters) … gameplay can be described in two layers: the ''ludus'' or game mechanics layer that involves rules and actions, and the narrative layer that comprises the setting, plot, and/or characters (Ang, 2006) It is agreed that gameplay lies in the meaningful interplay between the two layers – (Ke, 2016)

Game mechanics

- According to Sicart (2009a), the game mechanic is an activity structure that consists of rules and the actions afforded to players by those rules. The game mechanic can also be understood as ''a compound activity composed of a suite of actions'' (Salen & Zimmerman, 2004, p. 316). The essential activity that players repeatedly perform and directly apply to achieve the end-game state is usually described as a core mechanic – (Sicart, 2009a)

MDA - Game mechanic vs Game dynamics and game Aesthetic

- The difference between games and other entertainment products (such as books, music, movies and plays) is that their consumption is relatively unpredictable. The string of events that occur during gameplay and the outcome of those events are unknown at the time the product is finished. The

MDA framework (Hunicke et al., 2004) formalizes the consumption of games by breaking them into their distinct components (rules system "fun") establishing their design counterparts (mechanics dynamics aesthetics). **Mechanics** describes the particular components of the game, at the level of data representation and algorithms. **Dynamics** describes the run-time behavior of the mechanics acting on player inputs and each others' outputs over time. **Aesthetics** describes the desirable emotional responses evoked in the player, when she interacts with the game system. Fundamental to this framework is the idea that games are more like artefacts than media. By this we mean that the content of a game is its behavior not the media that streams out of it towards the player. […] From the designer's perspective, the mechanics give rise to dynamic system behavior, which in turn leads to particular aesthetic experiences. From the player's perspective, aesthetics set the tone, which is born out in observable dynamics and eventually, operable mechanics.

Gamification

- the use of game design elements in non-game contexts – (Deterding, Sicart, et al., 2011)
- the use of video game elements in non-gaming systems to improve user experience and user engagement … core to the definition is that a game is not created in doing so; instead, a pre-existing process … is augmented with characteristics borrowed from games – (Landers, 2014)
- the use of game design elements in non-game context(s) in order to influence user behaviour – (Versteeg, 2013)
- a process of enhancing services with (motivational) affordances in order to invoke gameful experiences and further behavioral outcomes – (Hamari et al., 2014)

educational gamification vs serious gaming

- gamification is designed to augment or support pre-existing instructional

content … (whereas) serious games are typically designed to fulfil the role of instructor by actually providing instructional content to learners … serious games are traditionally theorized to affect learning directly … (while) gamification alter(s) an intermediary learner behavior or learner attitude, (which) must then itself cause changes in learning directly (as a mediating process) or strengthen the effectiveness of existing instructional content (as a moderating process) – (Landers, 2014)

Serious Games

- serious games (are) also called learning games, games for learning, educational games, and training games, among other terms) … a serious game is defined as "a game in which education (in its various forms) is the primary goal, rather than entertainment" (Michael & Chen, 2005, p. 17) – (Landers, 2014)
- Serious games - games that express and inspire underlying epistemic frames, values, and beliefs (Shaffer, 2006) to foster informal learning - can be considered as a school of learning games … According to (Klopfer et al., 2009), a learning game is one that targets the acquisition of knowledge as its own end and foster(s) cognition that is either generally useful or useful within an academic context – (Ke, 2016)
- Serious games, gamification and game-based learning are distinct from entertainment-oriented games in that, while they are often also enjoyable, they are designed for primary end purposes other than entertainment and leisure (Davidson, 2008; Hamari et al., 2016)

Game Based Learning (GBL)

- The terms serious games and GBL are sometimes used synonymously, although serious games have been developed for the broader purposes of training and behaviour change in business, industry, marketing, healthcare and government NGOs as well as in education (Sawyer & Smith, 2008). Relatively few papers in the review were classified as serious games. All of

these had educational intent and could have been categorized as games for learning – (Connolly et al., 2012)

- In GBL the objective of the computer game is not to entertain the player, which would be an added value, but to use the entertaining quality for training, education, health, public policy, and strategic communication objectives (Zyda, 2005) – (Wouters et al., 2013)

Simulations

- Simulations are interactive digital learning environments that imitate a real-life process or situation. Simulations allow learners to test their hypotheses of the effects of input variables on the intended outcomes (de Jong, 1991; Fletcher & Tobias, 2006) – (Merchant et al., 2014)
- the only difference between a serious game (SG) and a video game (VG) lies in their intended purpose: usefulness for the former, entertainment for the latter. That is to say, SGs are VGs with a useful purpose – (Girard et al., 2013)

Casual games

- Because the definition of what makes a game casual is unclear (Juul, 2009; Kuittinen, Kultima, Niemelä, & Paavilainen, 2007), this paper defines casual games as games that are distributed by companies that label themselves as casual game distributors, following indications from the Casual Games Association. Casual games are simple in interface and are mainly played on web browsers, mobile devices, or downloaded to the PC. They include arcade games, brain teasers, word, board, jigsaw, trivia, hidden object, mah-jong, card, simulation, and puzzle adventure games.

Game genres

- The term game genre is used to classify video games according to the type of gameplay interaction, rather than their visual or narrative differences. It should be noted that, due to the fast changing landscape of gaming, new game genres appear and become popular every now and then, and it may happen

that the same game belongs to more genres simultaneously. Examples of game genres are as follows:

- Casual puzzle game; Action; Adventure; Strategy; Role-playing; Simulation; Construction – (Ke, 2016)
- First-person Shooter (FPS); Strategy games; Sports games; Role-playing Games (RPG); Puzzle games; Racing games; Dance/Rhythm games; Adventure games – (Yuan et al., 2011)

MMORPGs

- A MMORPG (Massively Multiplayer Online Role Playing Game) is a network-based, three dimensional, interactive, narrative environment which is permanent and consistent (Achterbosch, Pierce, & Simmons, 2008). It is narrative because it follows a certain plot and consistent because when a player logs out of the game or just takes a break, the game continues to exist in real time and "space" on the Internet (Hartshorne, VanFossen, & Friedman, 2012). Massively Multiplayer refers to the mass participation of players that can reach millions of users per game. Role Playing refers to the fact that the player assumes the role of a fantasy avatar in-game; the player is responsible for his/her avatar's actions and interacts with other players in-game (Hartshorne et al., 2012; Yee, 2006). Players "train" their avatars (also known as "characters") through accomplishing various missions (quests). These quests reward the player's "character" with experience points (XP points) which can be used, accumulated or exchanged with power ups (leveling), magic abilities and in-game objects. All of the above in turn, help the character to advance in further stages/levels of the game while this process is becoming repetitive, more difficult and challenging (Achterbosch et al., 2008; Ducheneaut & Moore, 2004; Hartshorne et al., 2012; Peterson, 2012). Because MMORPGs have game rules, provide feedback, and users are in a state of continuous interaction with the environment and other users, they are different from social worlds such as Second Life, which have no

embedded gameplay (Bell, Smith-Robbins, & Withnail, 2010). (Sourmelis et al., 2017)

Augmented reality

- The ways in which the term "Augmented Reality" (AR) has been defined differ among researchers in computer sciences and educational technology. A commonly accepted definition of augmented reality defines it as a system that has three main features: (a) it combines real and virtual objects; (b) it provides opportunities for real-time interaction; and (c) it provides accurate registration of three-dimensional virtual and real objects (Azuma, 1997). (Klopfer & Squire, 2008, p. 205) define augmented reality as "a situation in which a real world context is dynamically overlaid with coherent location or context sensitive virtual information". According to (Carmigniani & Furht, 2011), augmented reality is defined as a direct or indirect real-time view of the actual natural environment which is enhanced by adding virtual information created by computer. Other researchers, such as Milgram, Takemura, Utsumi, & Kishino (1995) argued that augmented reality can be considered to lie on a "Reality–Virtuality Continuum" between the real environment and virtual environment. (Koutromanos et al., 2015)
- "augmented reality games are games played in the real world with the support of digital devices (PDAs, cellphones) that create a fictional layer on top of the real world context" (Squire & Jan, 2007).

Virtual worlds

- Virtual worlds may contain one or more of the following features: the illusion of being in a 3-D space, the ability to build and interact with 3D objects, the digital representation of learners in form of avatars. Usually virtual worlds are open-ended environments in which users design and create their own objects and interact with other learners in the virtual world (Merchant et al., 2014)

Flow

- Flow refers to a state of mind characterised by focused concentration and elevated enjoyment during intrinsically interesting activities (Csikszentmihalyi, 1990)

7.2. Literature review queries executed on the Scopus and Web of Science databases

Scopus, Psychology:

ABS ((game* OR gaming OR videogam* OR gamif* OR mmorpg* OR rpg*) AND NOT "game theor*" AND NOT "olympic" AND NOT "commonwealth" AND NOT "gamet*" AND NOT "ultimatum game" AND NOT "dictator game" AND NOT "dilemma game" AND NOT "economic game" AND NOT "evolutionary game" AND NOT "public goods game") AND KEY ((game* OR gaming OR videogam* OR gamif* OR mmorpg* OR rpg*) AND NOT "game theor*" AND NOT "olympic" AND NOT "commonwealth" AND NOT "gamet*" AND NOT "ultimatum game" AND NOT "dictator game" AND NOT "dilemma game" AND NOT "economic game" AND NOT "evolutionary game" AND NOT "public goods game") AND ABS (Psycholog* OR neuropsych* OR cogniti* OR behavi* OR memory OR "problem solving" OR "decision making" OR creativity OR "critical thinking" OR addict* OR depression OR anxiety OR stress OR engagement OR motivation OR flow OR immersion OR enjoyment OR emotion OR emotive OR affective OR autonomy OR "self-regulation" OR attention OR concentration OR cooperation OR collaboration OR competition OR arousal OR empath* OR reward*) AND KEY (Psycholog* OR neuropsych* OR cogniti* OR behavi* OR memory OR "problem solving" OR "decision making" OR creativity OR "critical thinking" OR addict* OR depression OR anxiety OR stress OR engagement OR motivation OR flow OR immersion OR enjoyment OR emotion OR emotive OR affective OR autonomy OR "self-regulation" OR attention OR concentration OR cooperation OR collaboration OR competition OR arousal OR empath* OR reward*) AND PUBYEAR > 2010 AND DOCTYPE ("ar" OR "bk" OR "ip" OR "re")

Scopus, Education:
ABS ((game* OR gaming OR videogam* OR gamif* OR mmorpg* OR rpg*) AND NOT "game theor*" AND NOT "olympic" AND NOT "commonwealth" AND NOT "gamet*" AND NOT "ultimatum game" AND NOT "dictator game" AND NOT "dilemma game" AND NOT "economic game" AND NOT "evolutionary game" AND NOT "public goods game") AND KEY ((game* OR gaming OR videogam* OR gamif* OR mmorpg* OR rpg*) AND NOT "game theor*" AND NOT "olympic" AND NOT "commonwealth" AND NOT "gamet*" AND NOT "ultimatum game" AND NOT "dictator game" AND NOT "dilemma game" AND NOT "economic game" AND NOT "evolutionary game" AND NOT "public goods game") AND (ABS (learn* OR teach*

OR pedagog* OR educat* OR school* OR universit* OR instruction* OR pupil* OR student* OR grades OR class OR classroom) AND KEY (learn* OR teach* OR pedagog* OR educat* OR school* OR universit* OR instruction* OR pupil* OR student* OR grades OR class OR classroom))AND PUBYEAR > 2010 AND DOCTYPE ("ar" OR "bk" OR "ip" OR "re")

Scopus, Ethics:

ABS ((game* OR gaming OR videogam* OR gamif* OR mmorpg* OR rpg*) AND NOT "game theor*" AND NOT "olympic" AND NOT "commonwealth" AND NOT "gamet*" AND NOT "ultimatum game" AND NOT "dictator game" AND NOT "dilemma game" AND NOT "economic game" AND NOT "evolutionary game" AND NOT "public goods game")
AND KEY ((game* OR gaming OR videogam* OR gamif* OR mmorpg* OR rpg*) AND NOT "game theor*" AND NOT "olympic" AND NOT "commonwealth" AND NOT "gamet*" AND NOT "ultimatum game" AND NOT "dictator game" AND NOT "dilemma game" AND NOT "economic game" AND NOT "evolutionary game" AND NOT "public goods game")
AND ABS (ethic* OR moral* OR aggressi* OR discriminat* OR prejudic* OR toleran* OR diversity OR sexis* OR "social justice" OR equity OR equality OR racis* OR racial OR inclusion OR exclusion OR disabled OR disabilit* OR exploita* OR violen* OR bully* OR bullism OR privacy OR immigra* OR "social integration" OR "multicultur*" OR "gender")
AND KEY(ethic* OR moral* OR aggressi* OR discriminat* OR prejudic* OR toleran* OR diversity OR sexis* OR "social justice" OR equity OR equality OR racis* OR racial OR inclusion OR exclusion OR disabled OR disabilit* OR exploita* OR violen* OR bully* OR bullism OR privacy OR immigra* OR "social integration" OR "multicultur*" OR "gender")
AND PUBYEAR > 2010 AND DOCTYPE ("ar" OR "bk" OR "ip" OR "re")

WoS, Psychology:
TS=((game* OR gaming OR videogam* OR gamif* OR mmorpg* OR rpg*) NOT "game theor*" NOT "olympic" NOT "commonwealth" NOT "gamet*" NOT "ultimatum game" NOT "dictator game" NOT "dilemma game" NOT "economic game" NOT "evolutionary game" NOT "public goods game") AND TS=(Psycholog* OR neuropsych* OR cogniti* OR behavi* OR memory OR "problem solving" OR "decision making" OR creativity OR "critical thinking" OR addict* OR depression OR anxiety OR stress OR engagement OR motivation OR flow OR immersion OR enjoyment OR emotion OR emotive OR affective OR autonomy OR "self-regulation" OR attention OR concentration OR cooperation OR collaboration OR competition OR arousal OR empath* OR reward*)
Type=Article, Book or Review
Language=English
Indexes=SCI-EXPANDED, SSCI, A&HCI, BKCI-S, BKCI-SSH
Timespan=2011-2017

WoS, Education:
TS=((game* OR gaming OR videogam* OR gamif* OR mmorpg* OR rpg*) NOT "game theor*" NOT "olympic" NOT "commonwealth" NOT "gamet*" NOT "ultimatum game" NOT "dictator game" NOT "dilemma game" NOT "economic game" NOT "evolutionary game" NOT "public goods game") AND TS=(learn* OR teach* OR pedagog* OR educat* OR school* OR universit* OR instruction* OR pupil* OR student* OR grades OR class OR classroom)
Type=Article, Book or Review
Language=English
Indexes=SCI-EXPANDED, SSCI, A&HCI, BKCI-S, BKCI-SSH
Timespan=2011-2017

WoS, Ethics:
TS=((game* OR gaming OR videogam* OR gamif* OR mmorpg* OR rpg*) NOT "game theor*" NOT "olympic" NOT "commonwealth" NOT "gamet*" NOT "ultimatum game" NOT "dictator game" NOT "dilemma game" NOT "economic game" NOT "evolutionary game" NOT "public goods game") AND TS= (ethic* OR moral* OR aggressi* OR discriminat* OR prejudic* OR toleran* OR diversity OR sexis* OR "social justice" OR equity OR equality OR racis* OR racial OR inclusion OR exclusion OR disabled OR disabilit* OR exploita* OR violen* OR bully* OR bullism OR privacy OR immigra* OR "social integration" OR "multicultur*" OR "gender")
Type=Article, Book or Review
Language=English
Indexes=SCI-EXPANDED, SSCI, A&HCI, BKCI-S, BKCI-SSH
Timespan=2011-2017

7.3. Complete coding schema

The following coding schema was defined and adopted for the literature review.

Table 4. Coding schema for Gaming Horizons literature review

Field	Subfields	Possible values	Coding instructions
Reference metadata	ID	A unique code identifying the record	imported from WOS or Scopus
	authors	As in paper	imported from WOS or Scopus
	title	As in paper	imported from WOS or Scopus
	source	Journal name or book name or Conf. Proc.Name	imported from WOS or Scopus
	year	Publication year as in source	imported from WOS or Scopus
	Type of publication	Book/ journal paper/ review as of database metadata	imported from WOS or Scopus
	Keywords	As in paper	imported from WOS or Scopus

	Abstract	As in paper	imported from WOS or Scopus
Database	*WOS*	y/n	Already coded
	SCOPUS	y/n	Already coded
	Other source	y/n	Y - if added manually
Coder		Coder's initials	Es: JE; DP, FP, FM, CB, FD, EDU-ETH team (for the papers coded by the team); PSY team (for papers coded by the team)
Relevance	*Relevance rating*	2000/1/2	0 for papers that are not relevant to GH; 1 for relevant; 2 for very relevant (i.e. should be read by all)
Disciplinary perspective	*EDU*	y/n	Y if relevant, one paper can be relevant to more than one perspective
	PSY	y/n	Y if relevant, one paper can be relevant to more than one perspective
	ETH	y/n	Y if relevant, one paper can be relevant to more than one perspective
	ART	y/n	Y if relevant, one paper can be relevant to more than one perspective
Topic		Open field (cannot be empty)	Main topic: e.g. effectiveness of serious games, games and motivation, games and violence, exploitative games. These will be made homogeneous ex post, based on discussion among coders.
Type of games	*Game category*	entertainment games/ Purposeful games/ gamification/ na	only one should be chosen between the following: entertainment games(entertainment games, videogames, computer games); Entertainment games used for learning: games developed for purposes other than learning used for learning purposeful games(games developed for purposes other than entertainment, e.g. for learning, behaviour change, affect change and attitude change, social impact) NB: Games developed for research purposes should be classified according to their use in the study.

			So, for example, if the researchers have developed a game that simulates an entertainment game, it should be classified as entertainment game. Gamification(application of game elements and/or gamefulness in non-game contexts) na–non specified, unclear or general transversal
	Game type	Open field	Game type as defined by author, choosing one term, the most frequently used (e.g. videogame computer game entertainment game serious game game with a purpose applied game educational game edutainment game persuasive game social impact game pervasive game alternate reality game augmented reality game exergame embodied game RPG MMORPG Location based game)
Research methodology	*method*	Qualitative/quantitative/mixed /theoretical/review	Traditional categorisation of research methods, independent of method adopted for data analysis. Only ONE method should be chosen, bearing in mind that review includes systematic review and meta-analysis
	scope	2000/1/2	Coder judgement on specificity/generality of the study; 0= very specific, e.g. only one game, or very narrow user target (e.g. only children with one disease); 2= concerning a wide range of games or a large population of users
	Methodological soundness	2000/1/2	0=weak (sample too small; very short intervention, faulty statistics); 2= robust
	Comments on generalisability	Open field	Free text explaining reasons for the ratings of scope and methodological

			soundness): e.g. sample too small, restricted educational context, etc.
Recommendations	*Explicit Recommendations*	As expressed by authors	
	Implicit recommendations	Expressed by coder	
	Stakeholder relevance	Developers/educators/users/policy makers/researchers	stakeholders addressed by the recommendations: if stakeholders do not fall in the given categories other can be added, using author terminology (e.g. health care professionals, businessmen, parents) More than one can be indicated, separated by ","
Classification problems		List of names of fields or subfields involved in the problem	

7.4. List of core literature reviews & meta-analyses retrieved from literature search and coded

7.4.1. Educational perspective

Abdul Jabbar, A.I., & Felicia, P. (2015). Gameplay engagement and learning in game-based learning: A systematic review. Review of Educational Research, 85(4), 740-779. doi:10.3102/0034654315577210

Bodnar, C.A., Anastasio, D., Enszer, J.A., & Burkey, D.D. (2016). Engineers at play: Games as teaching tools for undergraduate engineering students. Journal of Engineering Education, 105(1), 147-200. doi:10.1002/jee.20106

Boyle, E.A., Hainey, T., Connolly, T.M., Gray, G., Earp, J., Ott, M., Lim, T., Ninaus, M., Ribeiro, C., Pereira, J. (2016). An update to the systematic literature review of empirical evidence of the impacts and outcomes of computer games and serious games. Computers and Education, 94, 178-192. doi:10.1016/j.compedu.2015.11.003

Calderón, A., & Ruiz, M. (2015). A systematic literature review on serious games evaluation: An application to software project management. Computers and Education, 87, 396-422. doi:10.1016/j.compedu.2015.07.011

Connolly, T.M., Boyle, E.A., MacArthur, E., Hainey, T., & Boyle, J.M. (2012). A systematic literature review of empirical evidence on computer games and serious games. Computers and Education, 59(2), 661-686. doi:10.1016/j.compedu.2012.03.004

Clark, D.B., Tanner-Smith, E.E., & Killingsworth, S.S. (2016). Digital games, design, and learning: A systematic review and meta-analysis. Review of Educational Research, 86(1), 79-122. doi:10.3102/0034654315582065

Dicheva, D., Dichev, C., Agre, G., & Angelova, G. (2015). Gamification in education: A systematic mapping study. Educational Technology and Society, 18(3), 75-88.

Girard, C., Ecalle, J., & Magnan, A. (2013). Serious games as new educational tools: How effective are they? A meta-analysis of recent studies. Journal of Computer Assisted Learning, 29(3), 207-219. doi:10.1111/j.1365-2729.2012.00489.x

Hwang, G.-J., & Wu, P.-H. (2012). Advancements and trends in digital game-based learning research: A review of publications in selected journals from 2001 to 2010. British Journal of Educational Technology, 43(1), E6-E10. doi:10.1111/j.1467-8535.2011.01242.x

Ke, F. (2016). Designing and integrating purposeful learning in game play: A systematic review. Educational Technology Research and Development, 64(2), 219-244. doi:10.1007/s11423-015-9418-1

Merchant, Z., Goetz, E.T., Cifuentes, L., Keeney-Kennicutt, W., & Davis, T.J. (2014). Effectiveness of virtual reality-based instruction on students' learning outcomes in K-12 and higher education: A meta-analysis. Computers and Education, 70, 29-40. doi:10.1016/j.compedu.2013.07.033

Nebel, S., Schneider, S., & Rey, G.D. (2016). Mining learning and crafting scientific experiments: A literature review on the use of minecraft in education and research. Educational Technology and Society, 19(2), 355-366.

Sourmelis, T., Ioannou, A., & Zaphiris, P. (2017). Massively Multiplayer Online Role Playing Games (MMORPGs) and the 21st century skills: A comprehensive research review from 2010 to 2016. Computers in Human Behavior, 67, 41-48.

Wouters, P., & Van Oostendorp, H. (2013). A meta-analytic review of the role of instructional support in game-based learning. Computers and Education, 60(1), 412-425. doi:10.1016/j.compedu.2012.07.018

Young, M. F., Slota, S., Cutter, A.B., Jalette, G., Mullin, G., Lai, B., Simeoni, Z., Tran, M., Yukhymenko, M. (2012). Our princess is in another castle: A review of trends in serious gaming for education. Review of Educational Research, 82(1), 61-89. doi:10.3102/0034654312436980

Wang, R., DeMaria Jr, S., Goldberg, A., & Katz, D. (2016). A systematic review of serious games in training health care professionals. Simulation in Healthcare, 11(1), 41-51.

Wouters, P., van Nimwegen, C., van Oostendorp, H., & van Der Spek, E. D. (2013). A meta-analysis of the cognitive and motivational effects of serious games. Journal of Educational Psychology, 105(2), 249-265. doi:10.1037/a0031311

Wu, W.-H., Hsiao, H.-C., Wu, P.-L., Lin, C.-H., & Huang, S.-H. (2012). Investigating the learning-theory foundations of game-based learning: A meta-analysis. Journal of Computer Assisted Learning, 28(3), 265-279. doi:10.1111/j.1365-2729.2011.00437.x

7.4.1. Psychological perspective

Barry, G., Galna, B., & Rochester, L. (2014). The role of exergaming in Parkinson's disease rehabilitation: a systematic review of the evidence. Journal of Neuroengineering and Rehabilitation, 11(1), 33. http://doi.porg/10.1186/1743-0003-11-33

Bavelier, D., Green, C. S., Pouget, A., & Schrater, P. (2012). Brain plasticity through the life span: learning to learn and action video games. Annual Reviews of Neuroscience, 35, 391–416. http://doi.org/10.1146/annurev-neuro-060909

Bleakley, C. M., Charles, D., Porter-Armstrong, A., McNeill, M. D., McDonough, S. M., & McCormack, B. (2015). Gaming for health: A systematic review of the physical and cognitive effects of interactive computer games in older adults. Journal of Applied Gerontology, 34(3), NP166-NP189. http://doi.org/10.1177/0733464812470747

Boendermaker, W. J., Prins, P. J., & Wiers, R. W. (2015). Cognitive Bias Modification for adolescents with substance use problems–Can serious games help?. Journal of behavior therapy and experimental psychiatry, 49, 13-20.

Boyle, E., Connolly, T. M., & Hainey, T. (2011). The role of psychology in understanding the impact of computer games. Entertainment Computing, 2(2), 69-74. http://dx.doi.org/10.1016/j.entcom.2010.12.002

Boyle, E. A., Connolly, T. M., Hainey, T., & Boyle, J. M. (2012). Engagement in digital entertainment games: A systematic review. Computers in Human Behavior, 28(3), 771–780. http://doi.org/10.1016/j.chb.2011.11.020

Dong, G., & Potenza, M. N. (2014). A cognitive-behavioral model of Internet gaming disorder: theoretical underpinnings and clinical implications. Journal of Psychiatric Research, 58, 7-11. http://dx.doi.org/10.1016/j.jpsychires.2014.07.005

Fauth-Bühler, M., & Mann, K. (2017). Neurobiological correlates of internet gaming disorder: Similarities to pathological gambling. Addictive behaviors, 64, 349-356.

Ferguson, C. J., Coulson, M., & Barnett, J. (2011). A meta-analysis of pathological gaming prevalence and comorbidity with mental health, academic and social problems. Journal of Psychiatric Research, 45(12), 1573-1578. http://dx.doi.org/10.1016/j.jpsychires.2011.09.005

Granic, I., Lobel, A., & Engels, R. C. (2014). The benefits of playing video games. American Psychologist, 69(1), 66.

Green, C. S., & Bavelier, D. (2012). Learning, attentional control, and action video games. Current Biology, 22(6), R197-R206. http://dx.doi.org/10.1016/j.cub.2012.02.012

Kaptsis, D., King, D. L., Delfabbro, P. H., & Gradisar, M. (2016). Withdrawal symptoms in internet gaming disorder: a systematic review. Clinical Psychology Review, 43, 58-66. http://dx.doi.org/10.1016/j.cpr.2015.11.006

King, D. L., & Delfabbro, P. H. (2014a). Internet gaming disorder treatment: a review of definitions of diagnosis and treatment outcome. Journal of Clinical Psychology, 70(10),

942-955. http://doi.org/10.1002/jclp.22097

King, D. L., & Delfabbro, P. H. (2016). The cognitive psychopathology of internet gaming disorder in adolescence. Journal of Abnormal Child Psychology, 44(8), 1635-1645. http://doi.org/10.1007/s10802-016-0135-y

Kueider, A. M., Parisi, J. M., Gross, A. L., & Rebok, G. W. (2012). Computerized cognitive training with older adults: a systematic review. PloS One, 7(7), e40588. http://dx.doi.org/10.1371/journal.pone.0040588

Kuss, D. J. (2013). Internet gaming addiction: current perspectives. Psychology Research and Behavior Management, 6, 125-137. http://dx.doi.org/10.2147/PRBM.S39476

Kuss, D. J., & Griffiths, M. D. (2012). Online gaming addiction in children and adolescents: a review of empirical research. Journal of Behavioral Addictions, 1(1), 3-22. http://doi.org/10.1556/JBA.1.2012.1.1

Kuss, D. J., & Griffiths, M. D. (2012). Internet gaming addiction: A systematic review of empirical research. International Journal of Mental Health and Addiction, 10(2), 278-296

Meng, Y., Deng, W., Wang, H., Guo, W., & Li, T. (2015). The prefrontal dysfunction in individuals with Internet gaming disorder: a meta-analysis of functional magnetic resonance imaging studies. Addiction biology, 20(4), 799-808.

Miller, K. J., Adair, B. S., Pearce, A. J., Said, C. M., Ozanne, E., & Morris, M. M. (2014). Effectiveness and feasibility of virtual reality and gaming system use at home by older adults for enabling physical activity to improve health-related domains: A systematic review. Age and Ageing, 43(2), 188–195. http://doi.org/10.1093/ageing/aft194

Seaborn, K., & Fels, D. I. (2015). Gamification in theory and action: A survey. International Journal of Human-Computer Studies, 74, 14–31. http://doi.org/10.1016/j.ijhcs.2014.09.006

Toril, P., Reales, J. M., & Ballesteros, S. (2014). Video Game Training Enhances Cognition of Older Adults: A Meta-Analytic Study. Psychology and Aging, 29(3), 706–716. http://doi.org/10.1037/a0037507

Verheijden Klompstra, L., Jaarsma, T., & Strömberg, A. (2014). Exergaming in older adults: A scoping review and implementation potential for patients with heart failure. European Journal of Cardiovascular Nursing, 13(5), 388-398. http://doi.org/10.1177/1474515113512203

Weinstein, A., & Lejoyeux, M. (2015). New developments on the neurobiological and pharmaco-genetic mechanisms underlying internet and video game addiction. The American Journal on Addictions, 24(2), 117-125. http://doi.porg/10.1111/ajad.12110

Yen, J. Y., Liu, T. L., Wang, P. W., Chen, C. S., Yen, C. F., & Ko, C. H. (2017). Association between Internet gaming disorder and adult attention deficit and hyperactivity disorder and their correlates: Impulsivity and hostility. Addictive Behaviors, 64, 308-313. http://dx.doi.org/10.1016/j.addbeh.2016.04.024

Zhang, F., & Kaufman, D. (2015). Physical and Cognitive Impacts of Digital Games on Older Adults : A Meta-Analytic Review. Journal of Applied Gerontology, 35(11), 1189-1210. http://doi.org/10.1177/073346481456667

7.4.1. Ethical perspective

Ferguson, C. J. (2015). Do angry birds make for angry children? A meta-analysis of video game influences on children's and adolescents' aggression, mental health, prosocial behavior, and academic performance. Perspectives on Psychological Science, 10(5), 646-666. http://doi.org/10.1177/1745691615592234

Greitemeyer, T., & Mügge, D. O. (2014). Video games do affect social outcomes: a meta-analytic review of the effects of violent and prosocial video game play. Personality and Social Psychology Bulletin, 40(5), 578-589. http://doi.org/10.1177/0146167213520459

Yuan, B., Folmer, E., & Harris, F. C. (2011). Game accessibility: a survey. Universal Access in the Information Society, 10(1), 81-100.

7.5. Conceptual and Operational Frameworks for Ethics in the Gaming Field

Values at Play (VAP)

Mary Flanagan & Helen Nissenbaum propose a methodology called Values at Play (VAP) to support consideration for and integration of values in game design and game development education (Flanagan & Nissenbaum, 2007). In its original form, the VAP methodology proposed a checklist of key values for consideration in four activity phases of game design and development, as shown in the table below.

Table 5. Activity phases and values in the initial version of the Values at Play (Flanagan & Nissenbaum, 2007)

ACTIVITY PHASES	VALUES
Values Discovery	Diversity
	Justice
	Inclusion
	Equality
	Privacy
	Gender
Identification of Values-Based Conflicts	Equity
	Environmentalism
Implementation and Prototyping	security/safety
	creativity and expression
Values Verification	cooperation
	sharing
	trust
	authorship
	liberty

Values at Play subsequently developed into a major initiative devoted to furthering and broadening the pursuit of values-sensitive game design (http://valuesatplay.org/). In later publications dedicated to VAP the authors proposed a

five-step iterative VAP Development Cycle coinciding with phases typically undertaken in game development: planning, requirements review, analysis and design, implementation, verification and evaluation (Flanagan & Nissenbaum, 2014, p. 77). The authors also produced various design games intended to operationalise the VAP framework and provide concrete support for integrating the ethical dimension in the game development cycle and game design education (p.142).

Framework for ethical thinking in role-playing video games

Schrier (2014) proposes a model for conceptualizing and assessing ethical thinking in role-playing video games. This comprises four categories of ethical thinking skills/processes (reflection, information gathering, reasoning, and empathy) and identifies a set of drivers that interact with the four categories to determine ethical decision making in role-playing video games.

Four Component model of moral expertise

In their comparison of scripted (branching) and systemic approaches to moral/ethical engagement in gameplay, Formosa et al. (2016) apply the *Four Component model of moral expertise* developed by psychologist Narvaez (2008). The authors posit that the model "provides a framework for designers to create an empowered moral agent by outlining a comprehensive suite of ethical abilities for games to challenge and engage. According to the model, the skills that comprise moral expertise can be divided into four interconnected categories:

- Moral Focus
- Moral Sensitivity
- Moral Judgment
- Moral Action

Each of these categories cover seven sub-skills (making 28 in total) that can be targeted as part of moral expertise development. Engaging any of the four components of moral expertise implies engaging at least one of their associated sub-skills.

Applied games and gaming

Morality Play: a model for developing "moral expertise games"

In his PhD thesis, Daniel Staines proposes a model for developing "moral expertise games", i.e. games intended to promote moral expertise development, derived from Integrative Ethical Education (IEE) and the social constructivist approach to serious game design. The purpose of games designed with Morality Play is to walk the player through the four levels of expertise development entailed in IEE: identification, elaboration, procedural, and execution (Narvaez, 2008). Morality Play is modelled on this progression. The four levels of MP are:

- Level 1: Immersion in opportunities and examples
- Level 2: Attention to facts and skills
- Level 3: Practice procedures
- Level 4: Integrate knowledge and procedures

These also relate to the Four Component model of moral expertise (see above).

EPIC: A Framework for Using Video Games in Ethics Education

Schrier's (2015) multi-layered EPIC Framework includes consideration of both educational goals and strategies to meet those goals. The goals and strategies could be mixed and matched in different ways to help educators and designers select the most appropriate games for a particular educational need.

Educational Goals

- E1. Enhance ethical awareness
- E2. Enhance emotional intelligence
- E3. Practice care or empathy-related skills
- E4. Practice ethical reasoning
- E5. Practice ethical reflection
- E6. Enhance character
- E7. Cultivate facility with major ethics issues, approaches, and frameworks

Strategies

- S1. Emotion, mood, and tone
- S2. Diaries or personal reflection devices
- S3. Role-taking and role-playing
- S4. Story or narrative
- S5. Modeling through avatar or character
- S6. Choices and consequences
- S7. Simulation
- S8. Social interaction and collaboration
- S9. Deliberation, dialogue, and discourse
- S10. Applications to real-world issues
- S11. Procedural exploration and interaction
- S12. 'Nudges' or contextual and/or personalized clues

For each of the above strategies, a set of example games is also suggested (see Listings of Ethically Significant Games below)

In conjunction with the EPIC framework, Schrier also proposes a set of Best Practices to draw on when creating games to teach ethical thinking. This is based on a survey of current frameworks and findings.

- Players should be exposed to alternative perspectives.
- Players should be able to deliberate with others.
- Players should be able to make choices.
- The choices should be relatable.
- The game's context should be personally meaningful and authentic.
- Any consequences should be appropriate.
- Players need time to develop relationships with their avatar and with other characters to build empathy for them.

Mindful design of ethical games

Warren & Lin (2012) propose a set of basic considerations supporting mindful design of ethical games and simulations intended for educational purposes.

- Will my intended audience benefit with minimal risks to them psychologically, socially, or educationally?
- Does my design have any inherent values that may contrast with what is best for the audience?
- Could there be unintended consequences of my design?
- Should I be using a game or simulation?

These are accompanied by a set of more detailed and specific considerations.

Ethical Considerations for Learning Game, Simulation, and Virtual World Design and Development

- What is my relationship to gaming, virtual world or simulations and is that influencing my recommendation that learning take place in one? Can I objectively say that I am not influenced by my own use of such products in such a way that I am not pushing for their use simply because I like them?
- Can I say that I can adequately predict use outcomes and minimize risk of psychological,
- social, or educational harm to learners?
- Can I ensure service for learners with disabilities such as visual or auditory impairment and still use games, simulations, or MUVEs?
- Can I parse out variables in the game, simulation, or MUVE sufficiently to properly evaluate the learning outcomes and say that my product improved some aspect of learning?
- Can I design and develop the product with the resources I have carefully and with mindfulness towards my audience, learning outcomes, and minimize untoward consequences in the time I have been given to do so?

- Am I, or those working with me, competent to build a game, simulation, or virtual world? Do we have the design and technical skills to produce a viable product with the resources available to us?
- At the conclusion of the design, will we be able to open it to others for evaluation, use and research or will it remain closed?
- Can I design this game, simulation, or virtual world and respect the intellectual property of others and give proper credit for ideas contained therein?
- Is the game, simulation, or virtual world I intend to build something I can say is socially responsible and will benefit learners within the context of established social, school, and local norms?

Socially Responsive Design Strategy

Barab et al. (2005) adopted a strategy they defined as "socially responsive design" for the development of the landmark environment, Quest Atlantis (QA)[53]. This is a highly successful multiuser virtual environment that embeds commercial gaming strategies to support learning among children aged 9 to 12. The overarching aim of QA was to "inspire participation consistent with social commitments and educational goals." The socially responsive design was underpinned by a set of core values identified for fostering "the formation of knowledgeable, responsible, and empathetic adults"

- Creative Expression – "I Express Myself"
- Diversity Affirmation – "Everyone Matters"
- Personal Agency – "I Have Voice"
- Social Responsibility – "We Can Make a Difference"
- Environmental Awareness – "Think Globally, Act Locally"
- Healthy Communities- "Live, Love, Grow"
- Compassionate Wisdom – "Be Kind"

*See also Jamey Stevenson's Framework for classification and criticism of ethical games

53 http://www.questatlantis.org/

(Stevenson, 2010).

Author listings of significant games for ethics and ethics studies

Some authors in the games and ethics field have provided lists of games considered particularly significant for ethics and ethics studies. These are included for reference.

Schrier (2015)

Table 6. Game strategies and related example games in the EPIC framework (Schrier, 2015)

Table 2. The list of 12 possible game strategies in the EPIC Framework, as well as examples of current games that use each strategy. Some games will use more than one strategy.

Strategy	Description	Examples
S1. Emotion, mood, and tone	Games that convey emotion in ways that help us see new perspectives on humanity.	*Flower, Journey, Gone Home, Dear Esther, Passage, Parenthood, Akrasia, Loneliness, Howling Dogs, Nevermind*
S2. Diaries or personal reflection devices	Games use journals, diaries and other personal reflection devices and opportunities.	*Reliving the Revolution, Mission US.*
S3. Role-taking and role-playing	Games that use roles and characters to help explore different ethical perspectives and identities, or one's own.	*Fable, Mass Effect, Dragon Age, Migrant Trail*
S4. Story or narrative	Games that use story to express ethics.	*Mission US, Stanley Parable, Dys4ia, Walking Dead, Howling Dogs, Dear, Esther, Every Day the Same Dream*
S5. Modeling	Games that model behavior using characters and/or avatar.	*Mass Effect, Fable, Fallout, Mission US, Awesome Upstanders*
S6. Choice and consequences	Games with ethical choices and decision-making, which have an effect on the game play	*Fallout 3, Fable series, Skyrim, Walking Dead, The Stanley Parable, Papers, Please, Quandary, Spec Ops: The Line, the Yahwg*
S7. Simulation	Games that simulate an issue, topic, event or aspect of humanity.	*Sweatshop, Papers, Please, Peacemaker, Don't Starve, Black and White, The Sims*
S8. Social interaction	Games that invite ethical questions due to their social nature, such as those with community rules and norms, guild interactions, or interpersonal connections.	*WoW, Minecraft, Way, Counterstrike, League of Legends*
S9. Deliberation, dialogue and discourse	Games that encourage dialogue, discourse, debate and deliberation on various issues, choices, or consequences.	*Argument Wars, Reliving the Revolution*
S10. Application to real-world issues	Games that either may enable players to consider real-world problems or contexts, or ones that may not have initially obvious connections to ethics, but the story around the game (addiction, violence) spurs real-world ethical questions and problem-solving.	*The Migrant Trail, Candy Crush Saga, Grand Theft Auto, Blackwell Deception, Rapelay, Super Columbine Massacre, The Shooting at Sandy Hook, Call of Duty* series
S11. Procedural exploration	Games that clearly posit an opinion or argument on an issue through the gameplay and mechanics.	*McDonalds Game, Airport Security, Unmanned, Papers, Please, pOnd, Every Day the Same Dream, Free Culture, Road Not Taken, Way, Triad, Lim, Loneliness, What Race am I?*
S12. 'Nudges'	Games that provide contextual clues, calibrations, and/or personalized pushes to help shape behavior.	*Way, Nevermind, SchoolLife, Gone Home*

Listings of ethically significant games

Schrier (2014)

- AEINS
- Akrasia
- Howling Dogs
- Hush
- Seeds by Nahil Sharkasi
- September 12

- Airport Security
- Awesome Upstanders
- Bastion
- Bioshock series
- Buffalo
- Cart Life
- Darfur is Dying
- Dear Esther
- Deus Ex
- Deus Ex: Human Revolution
- Diplomacy
- Dragon Age Series
- Dys4ia
- EthicsGame by Catharyn A. Baird
- Ico
- Knights of the Old Republic
- LA Noire
- Layoff
- Lim
- Madrid Game
- Mass Effect series
- McDonald's Game
- Mirror's Edge
- Mission US series
- Oblivion
- Papers, Please
- Paralect
- Passage
- Spec Ops: The Line
- Super Columbine Massacre RPG
- Sweatshop
- Skyrim
- The Arab-Israeli Conflict and First Wind
- The Shooting at Sandy Hook
- The Stanley Parable
- The Suffering
- The Walking Dead Season One/Two
- The Yawhg
- Train by Brenda Brathwaite/Romero
- Triad
- Unmanned
- Way

- Everyday the Same Dream
- Fable Series
- Fallout 3
- Fallout: New Vegas
- Gone Home
- Grand Theft Auto series
- Grow-A-Game by Values@Play
- Heavy Rain
- Parenthood
- Peacemaker
- pOnd
- Portal/Portal 2
- Quandary Game by Learning Game Network
- Re:Activism by PETLab
- Red Dead Redemption
- River of Justice

See also Jamey Stevenson's Framework for classification and criticism of ethical games (Stevenson, 2010).

7.6. Professional Codes Of Ethics in the Gaming Field

Game Development

The International Game Developers Association (IGDA) has a voluntary professional code of ethics[54] that members are implicitly expected to uphold and that IGDA Board Members are required to formally undersign (private communication, 26 Jan., 2017). The CoE covers 23 points of professional conduct in three different areas (principles,

54 https://www.igda.org/?page=codeofethics

workplace and leadership). Generally, it recognises "the importance of the effect of ideas conveyed through art, and especially the effect of ideas presented in an interactive choice-driven format." The Code is largely devoted to professional conduct within the gaming industry but on the question of content and values, one of the 23 points expresses a commitment "to create content appropriate for our stated audience".

Gamification

Some Codes of Ethics have emerged in the gamification sector as the result of personal initiatives promoted by individual advocates of gamification. One such is the Open Gamification Code of Ethics (http://ethics.gamified.uk/). This initiative grew out of the gamification code of ethics suggested by Andrzej Marczewski in 2013 and at the time of writing (February 2017) counts 52 online signatories. This code, updated in December 2015, is as follows:

Honesty

- Gamification designers should be honest with both users and clients.
- Clients should be made aware that Gamification is not a magic bullet. In most cases, it is a long term investment.
- Gamification should not be used as a way to dishonestly gather information that a user would not freely give up under other circumstances.
- Gamification designers will not claim propriety of other's published work.

Integrity

- Gamification should take into consideration accepted regional social practices, personal or ethical boundaries and general human rights, and should not be used to manipulate people into breaking them.
- Gamification should not be used for illegal activities (as defined by the laws of the countries and locales for which its use is intended).
- Gamification should not be used to manipulate children for commercial purposes.

Transparency

- Encourage openness about the system to both users and clients, (within the limits of copyright, intellectual property and trade secrets), such as;
- What the aims of the system are
- What data the system will collect
- How the data collected is to be used
- Encourage free access to information.
- Never share personal data without the appropriate consent.

Quality

- As a gamification designer, you should always provide the best service and experience possible for every user and client.

Respect

- Gamification should not be used to make statements justifying violence, LGTBphobia, racism, abuse, misogyny or similar.
- Consider the impact and sustainability that projects and workshops may have on the environment.

Another, less detailed, Code of Ethics proposal has been made by Gabe Zichermann as part of the Engagement Alliance (http://engagementalliance.org), a gamification agency "with three core objectives: Education, Advocacy and Research" (http://www.gamification.co/2012/12/10/code-of-gamification-ethics/). Versteeg (2013) reports Zichermann's proposal thus:

- As an accredited Gamification Designer, I pledge my best effort to act in accordance with the following principles when creating systems of engagement:

- I will strive to design systems that help individuals, organizations and societies achieve their true potential, acting consistently with their values and enlightened interest.
- I will not obfuscate the use of game mechanics with intent to deceive users about the purpose or objectives of the system.
- Where practical by law and contract, I will make an effort to share what I've learned about motivating behavior with the community so that others may leverage this understanding to advance society and the state of the art.

In his study of gamification ethics, Versteeg (2013) proposes a simplified framework for moral persuasive gamification design that draws on elements from the aforementioned proposals and merges these with the normative framework (moral standards regulating conduct). The stated purpose of Versteeg's proposal is to indicate "what designers can do to systematically signal and address potential ethical issues in their design" (Versteeg, 2013, p. 47). The framework can be summarised thus:

1. Moral principles and values

- Designers should not seek to persuade anyone of behaviour they themselves would not consent to be persuaded of.
- The intended behaviour of persuasive technology should not be dangerous, harmful or risk-increasing to users or their surroundings.
- Persuasive technology should aim to benefit the majority of users, both in behaviour and in moral character. (i.e., it should stimulate virtue, not vice.)
- The persuasive technology should not discriminate; it should treat users in identical circumstances equally.
- Designers should disclose their motivations and intended outcomes, thereby avoiding deception to achieve their persuasive goals.
- Designers should take the responsibility to examine and evaluate reasonably predictable outcomes of the technology they design.

2. Conceptual investigation

- List both direct and indirect stakeholders potentially affected by the gamified system-in-design.
- (write) scenarios … to envision positive and negative outcomes of the intended persuasion of the gamified system.

3. Involve stakeholders

- Corroborate and supplement the results of the conceptual investigation by investigating stakeholders' opinions and feedback.
- consider inviting stakeholders to collaborate in the design process.

4. Evaluate and iterate

- select specific technical features in the basis of results from the ethical inquiry