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Technically Toys

Towards a Post-Digital World with Play Machines and Artificial Friends

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Abstract

The concepts of what a toy is and what play as a phenomenon represents, evolve. This paper examines how play is affected by digital toys and toy robotics, conceptualized here as play machines. The position paper offers pluralistic perspectives on play machines in an era heading towards a post-digital state by combining earlier research on the historical trajectory of mobile toys with current developments in interactive toys. The paper reconceptualizes toys as interactive media connecting with thingness, transmedia, and technology as perspectives on the toy medium. Finally, the paper illustrates the connections between an emerging category of toys, Internet-connected character toys, and companion robotics, which in speculative toy fiction emerge as future 'toy friends' or Artificial Friends, offering enriched possibilities for motion and emotion in player engagement.

Keywords: Artificial intelligence, digital play, IoToys, robotics, speculative fiction, play machines

Introduction: Thingness, transmedia, and technology of the toy medium

Toys are not just keeping pace with enveloping media; they are evolving alongside it (Jenkins, 2010). Digital communication has sparked a profound revolution in the toy world, ushering in a new era of technologically-enhanced and technologically-enriched toys (Pesce, 2000), which to a part, transform the landscape of toys. Marsh and colleagues (2016) note that digital play has become a common type of play, which often manifests in the usage of screens. Most notably, digital play in the 2020s is associated with playing digital games, as shown by Flynn et al. (2019, 68-69):

As technological innovations have become increasingly complex and media increasingly pervasive in children's lives, we suggest it is crucial to understand the

features of interactive digital games that have greater impact on children’s social and cultural environments—particularly on the nature of play.

Digital play extends to adult play cultures. Furthermore, and more importantly, digital play traverses the boundaries of gameplay and interaction through screens: Digitality has become relevant regarding three-dimensional playthings, namely toys and, more specifically, *character toys*.

The paper at hand represents a position paper. A position paper enables discussion on emerging topics without the experimentation and data collection associated with original research. Instead, to explore how toys merge increasingly with machines, the author builds on earlier toy and play research interested in the connections between toys and technology and their joint evolution regarding digitalization and connectedness.¹

The importance of studying the evolution of the toy medium into *play machines*, or, digital toys and toy robotics, is grounded in several areas of the consequences of human play with these entities, namely the impact this interaction has on players’ physical, cognitive, and emotional behavior, specifically, movement on many levels, and related play patterns categorized from the perspectives of *ludic* and *paidic* play (Caillois, 1961).

The exploration of the evolution mentioned above begins by associating toys with an earlier conceptualization of media. Leaning on the five qualities of media (Auferheide, 1992), the first argument is that the toy medium is *constructed and constructs reality*: The earliest toys that resulted from developments in other media products evolved in the 19th century. Secondly, toy media has *commercial implications*: The toy industry is a multi-billion dollar industry with manifold linkages to other media production. The best-selling toys are often the ones that are linked to media (Levin, 2010).

By the late 1980s, as much as 70 percent of gross toy sales consisted of licensed toys (Kline, 1993). In 2022, licensed toys accounted for over 30% of the overall toy market (Loveday, 2023). Third, the growing significance of toys beyond entertainment as part of education (or *toy-based learning*; Heljakka & Ihamäki, 2018), as well as other instrumental uses of toys, such as *serious toy play*, for example, toy activism (Heljakka, 2021) illustrate, how toy media have *ideological and political implications*. Fourth, forms of media *rely on certain aesthetics*. *Toyification* (Thibault & Heljakka, 2018) “communicates the idea of an entity (physical, digital or hybrid)

¹. This paper builds on the arguments presented in Heljakka (2024), namely, in the doctoral thesis *How Play Moves Us: Toys, Technologies, and Mobility in a Digital World*.

being intentionally reinforced with toyish elements or dimensions; an object, a structure, an application, a character or a technology designed to acquire a toyish appearance, form or function,” and demonstrates the unique aesthetics of the toy medium. Fifth, and finally, players negotiate *meaning* in toy media—they are the users in toy media cultures: choosers, interpreters, shapers, fellow players, participants, and storytellers (Jones, 2002).

In simpler terms, contemporary toys are powerful media. Namely, the *play machines* discussed in this paper may be considered independent material artifacts (*Thingness*), part of crossover phenomena online and offline (*Transmedia*), and, more significantly, extensions to socio-technological media (*Technology*) (see Figure 1). These dimensions will be discussed in more detail in the following.

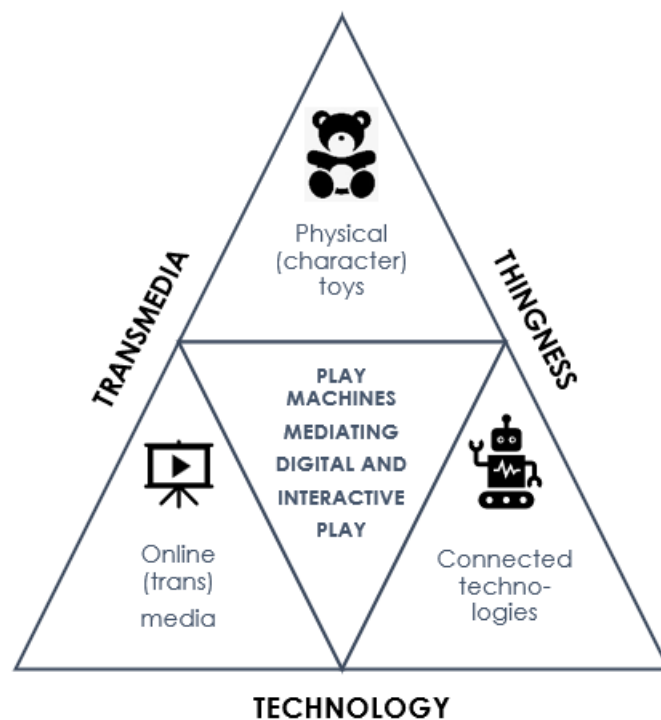


Figure 1. Play machines mediate play in the intersection of physical toys (*thingness*), offline/online (*trans*)*media*, and interactive and connected technologies (*technology*).

Thingness

Let us explore each of the dimensions of the play machines individually. The first area of significance for the play machines under scrutiny is their connection to

material culture—their *thingness*. Sutton-Smith (2017) has highlighted that the most apparent modern manifestations of play as a consumable experience include children's toys, computers, and video games. As new tools and services, such as interactive and persuasive 'toy friends' with game-like interaction possibilities emerge in the supersystem of play (Heljakka, 2013), play acquires more specialized features.

New kinds of interactive toys represent a 'media mix' (Ito, 2008) that effectively combines toys, games, the media, and the internet, notes anthropologist Minna Ruckenstein (2010). That is to say that the notion of thingness has expanded into the understanding of physical materiality and digital materiality that intertwine in the current world of play machines. In these convergent playthings, digital and physical materiality are entangled (Pink et al., 2016). From the paper's perspective, these playthings are treated as objects and devices, or in common terms, play machines.

Yelland (1999) notes how the concept of 'toy' has changed considerably with the advent of emerging digital technologies that have brought additional dimensions to objects that had previously been relegated to a passive role in their interactions with children. Johnson and Christie (2009, 284) assert, "Digital toys can serve as catalysts for new forms of play and can have a positive influence on the content of more traditional forms of play." As argued in the paper, technologically enhanced toys have developed into entities that move by themselves and, in due course, generate movement in play. The mobility of toys has consequences on perceptions of the toy's liveliness and 'aliveness': "The object's 'aliveness' facilitates identification. At the same time, its 'thingness' helps us keep a secure distance" (Ackermann, 2005, 1).

Transmedia

Toys are objects as well as media—they have been categorized as children's classical media (Mouritsen, 1999). Jenkins (2010) has claimed: "Media is changing play, and play is changing media". Consequently, the evolving media landscape also influences the shape of new playthings. Contemporary play is transmedial in many senses, primarily due to content spread across media, including toys. Therefore, the second area of relevance for play machines is their connections to transmedia.

According to Fleming (1996), the commodified toy depended on other media at the beginning of the 20th century, such as radio and television. The result of evolving media technologies has allowed the sphere of play to expand from the physical world to the online spaces, making toys crossover media (Nayar, 2010). Essentially, this development is bidirectional, and online activities influence the emergence of

new playthings and play patterns. For example, at the beginning of the 21st century, social media as a platform for digital play has significantly impacted the development of new toys (Heljakka, 2016).

Edwards (2013) defines *converged play* as the intersection of children's popular culture, including digital media, with traditional forms of play. These two forms of play are interrelated rather than oppositional. The technologization and connectedness of toys influence socialization and interpersonal skills concerning toy play as the play machines investigated here represent *interactive* playable technologies. Connected playthings are part of the digital playground of the twenty-first century (Kafai & Fields, 2013), offering expanding possibilities for social play.

Commonly, creatures do not play alone but with others like themselves, and humans are no exception (Henricks, 2015)—"play is social *interaction* as much as it is private *action*." (101). In this way, toys are both solitary and social media. Social interactivity implies connectedness; today, this means using digital media technologies and associated devices. Consequently, this paper argues that digital toys of current times and the near future reside in the cross-section of human-machine communication, digital play, and popular culture.

Digital technologies inform play, and children enjoy playing with toys that are digitally enabled in some way. Furthermore, toys as extensions to socio-technological media and vice versa make toys of the post-digital age an even stronger communication medium; connected toys (*IoT*), the newest thread of intelligent toys, allow interaction between players through their online connectedness. Indeed, we are now in a situation in which the online realm and the world of physical objects are beginning to intersect and influence one another (Pesce, 2000), expanding access points for players of toys to online media. Media environments entertain and socialize (Çetintaş & Turan, 2018). For the play machines, this means increased possibilities for social play, as players connect to peer players through social media platforms, as well as through IoT or the Internet of Things, to devices with intelligent features, combining offline and online environments.

Technology

The third and final area of investigation of relevance to the play machines is relatively clear-cut and self-explanatory: the connection of the play machines to technology. The evolving technological media landscape impacts cultural and societal shifts in developing and playing with toys. Play and creativity can be

fostered through the use of technology (Marsh et al., 2018). The effects of digitalization and robotization on children's and adults' play patterns and behaviors are broad. As suggested, playing with technological devices, such as developed toys, mobilizes the players in various ways (Heljakka & Ihamäki, 2018), but why is this the case?

The technologically mediated play has been described as 'omnipotent play' and '360 degrees play' and manifests as play content mediated through screens, apps, and social media platforms. The tablet is the dominant screen in children's digital play (Marsh et al., 2018). Children, nowadays, even a growing number of adults, see tablets as toys (Lundtofte, 2020). What complicates the understanding of digital play with toys even further are the toys that are interacted with through a device in the name of *hybrid play*. To exemplify, this is illustrated in a conversation between Cady and her father in the popular film *M3gan*: "Honestly, what is the purpose of a toy if you have to play with it on an iPad?", asks the father of Cady (Johnstone, 2022). However, toy development has always been steered by techno enthusiasm, embracing new possibilities that add new layers to the interaction between the toy and the player. What was previously tied to the imagination can now be visualized on the screen as actions partaken by the toy. Using play machines, such as mobile devices, as extensions to toys and individual play machines offers new interaction possibilities, such as feeding an artificial pet with virtual food: "This is what the future looks like, okay? You have to get used to it," says Cady's mother, as her father wonders why playing with traditional toys needs to be enhanced with a device (Johnstone, 2022).

Liveliness, Interactivity, and movement of *play machines*

The advancement of information technologies has made it possible to merge the physical and digital worlds (Yelland, 1999). According to Cramer and Jandrić (2021, 18), the current era is moving in the direction of post-digitality, in which the distinction between 'digital' and 'non-digital' is becoming "less clear than it seems when it is rigorously inspected, and also less useful and relevant than it often seems."

In 2003, Nigel Thrift prophesied that digital technologies would make objects smarter and more animated. The influence of these technological advancements on toy design and functionality is not just significant; it is transformative. Kudrowitz and Follett (2014, 245) aptly describe this as a convergence of the analog and digital play worlds: "There is a toy box, and there is a smart device." These realms are not

just colliding; they are merging. With the introduction of Furby and Tamagotchi in the 1990s, the world became acquainted with a new category of toys: animatronics, enlivened by computer technology and inviting players to interact.

Interactivity contains two characteristics: at least two participants (human or non-human) and some technology allowing for mediated information exchanges between users through a channel (Kiousis, 2012), presented in this paper through the perspective of play machines. Today, this development continues with new Internet-connected toys and various toy robots, which, like earlier play machines, have “become our indispensable mechanical companions” (Pesce, 2000, 220), offering converging and hybrid resources for digital play. When active intelligence is added to this amalgamation, the world is introduced to entities that, according to Pesce (2000, 269), “listen to us, react to us, and learn from us, becoming more and more alive.”

It is argued here that play machines, as an evolving category of contemporary toys, are *mobile media*. Two major lines of development, motion, and emotion, are addressed as key dimensions of play machines, which may benefit toy players. Toy researcher Jean-Pierre Rossie (2005, 57) has observed in working with child-created toy cultures in the Western region of the Sahara in Africa that “One technological aspect to be solved by toy making [...] is movement, movement of parts of the toy or movement of the whole toy.”

Historically and technologically, toys have developed from early moving and mechanical automata to playthings demonstrating autonomous movement. Mobile technologies that support or encourage physical activity can be enjoyable for children who love to play outside and engage in whole-body movement (Plowman et al., 2012). For example, Flynn et al. (2019, 58) describe embodied interactivity as higher levels of using the complete body to interact with games.

One implication of mobile toys as well is their possibility to urge movement in players. Boon et al. (2020, 1) propose that “the characteristics of products and environments affect whether and how children play and move.” Maude (2010) suggests balance, locomotion, flight, manipulation, and projection as movement categories, which can help designers integrate diverse affordances for bodily play in their designs. Tactile, visual, embodied, and emotional ways that players engage through technologically mediated content, digital play, and digital toys are challenging ideas on digital play as “passive” and inactive.

Character toys, in particular—have transformed from entertaining, self-moving spectacles to educational machines that mobilize the player both physically and

spatially (Heljakka & Ihamäki, 2018), promoting an ‘off the couch’ mentality (Cumbo et al., 2014).

Movement may occur in many ways. This paper argues that digital playthings, as play machines, can physically and emotionally move players. In his landmark paper on the ‘super toys’ of the future, Nigel Thrift (2003, 390) envisioned how “new toys have become one of the chief test-beds for the new ways of emotions.”

During the past decades, toys as machines have indeed illustrated capacities that enable players to think of them as relatable companions who respond to our actions and, in this way, seem to have emotions of their own. They create a new space to explore action at a distance and relationships outside human presence (Ackermann, 2005). Brian Sutton-Smith (1993) observes that toys persuade the players about their affection. Character toys, meaning dolls, action figures, and soft toys or toys with a face (Heljakka, 2013), that in some cases have been turned into social robots, such as Internet-connected toys (*IoT* toys) and companion robots, such as robotic pets, or as fabulated and radical forms of innovation in instances of speculative fiction, Artificial Friends, or *AFs* (Ishiguro, 2021) can all be thought of as play machines with mobilizing tendencies illustrating physical and emotional movement, and a capacity to persuade that the players form relationships with them.

Liveliness, according to Berriman and Mascheroni (2019), is co-realized by children and toys. Perceiving emotions in toys has become the child’s tool for understanding her feelings (Pesce, 2000). This presents both problems and possibilities. For example, the original Tamagotchi brought to the market in the 1990s relied, according to Pesca (2000), on emotional manipulation. Since the introduction of Tamagotchi, several more advanced robotic toys have entered the toy market, such as the Joy for All companion pets or robotized cats and dogs, which signal far more subtle invitations to engage with them. Bartneck (2003) demonstrated that emotional expressions significantly enhance the experience of human interaction with robotic characters. The emotions lived and experienced in the company of the play machines, as presented in narratives of AI and speculative toy fiction, are highly controversial. Nevertheless, they have tremendous meaning for players who engage with the play machines.

Dimensions of the digital play experience: From screens to sensors

Typically, digital play experiences manifest through interaction with content mediated through screens, often through gameplay. However, as noted by Johnson and Christie in 2009, there was a need to shift between activities related to ‘screen

play' and 'actual play,' with the latter pointing to more traditional play experiences. Screen use in play presents multiple challenges, one of the most prominent being screen time. The concept of 'screen time' predates mobile games. Argues Hilvoorde (2016, 1) "the first generation of electronic games, such as Pong, was more or less categorized as 'screen time.'" During the past decade, hand-held devices to play (Enevold, 2014), which are mobile and connected, and in which Westecott (2008) writes, "the contact between the player and the digital game is mostly mediated through a flat screen", have become an everyday standard as play machines including a flat-screen format. Today, the screens of mobile devices allow the merging between physical and digital play, in which toy play is extended through digital photography (i.e., *photoplay*, see, e.g., Heljakka, 2013) or online applications.

Interactive technologies consumed through screens have social and personal implications. "This toy," Sutton-Smith (1986, 75), speaks of video games as a machine that not only isolates the child but also "possesses the child". Indeed, the detrimental consequences of the obsessive use of play machines are constantly debated among educationalists and parents of young children.

Recent popular culture films demonstrate societal conversations around devices with screens, focusing on the need to control the playtime used with them. To exemplify, "I thought we were gonna limit screentime to thirty minutes a day", says the father of Cady, nine years old, in the movie *M3gan* (Johnstone, 2022). Indeed, to many, new forms of play using digital technology in association with character toy play may seem curious and, in most cases, 'pre-programmed' play, as device use is often considered monotonous and uncreative. Perhaps the most concerning aspect of interaction with screens, in parallel to the belief that digital play limits the imagination, is combined with the belief of lack of physical movement in the screenplay and what Sutton-Smith (2017) has called an encapsulation indoors as a result of play associated with machines.

To remedy the fears associated with the assumed static and addictive usage of screen technologies, contemporary digital games aim at experiences in which the players need to raise their gaze from the flat surfaces of the screen to direct attention towards the physical, outdoor environment. For example, Soute and colleagues developed the concept of *Head Up Games* (HUGs), referring to traditional games enhanced with interactive technology while avoiding screens (Soute et al., 2010).

In a similar vein, Katherine Isbister (2016, 107) writes about the evolution of digital games: "Rather than immobilizing and devaluating their body, or isolating players from other people, games in the future have the potential to embrace and enhance the role of the body and movement in play. They may recouple the physical

and emotional, gracefully augment and transform our social interactions, and support our performance on who we are, or who we want to be.”

As Isbister (2016) has observed, the world has grown increasingly saturated with sensors and alternate feedback systems beyond big screens. In 2003, Luckin and colleagues defined digital toys as having tangible interfaces not bound to a desktop computer. Current developments in the cross-section of digital technologies and toys have introduced other types of interaction, enabling spatial and embodied play, which takes the focus off screens. Fizek (2017, 1) notes that “in a digital game, most of the processes are automated and hidden from the player’s view.” The same goes for digital toys, such as IoToys and social companion robots, in which inner structures are often hidden from view (Bogost, 2016). Hidden affordances are not apparent to the user and do not convey their existence through perception. To exemplify, Berriman and Mascheroni (2019) have discovered that active play is predominantly invited through three-dimensional physical toys and their physical affordances, such as the toy’s material, size, shape, and presentation. Technologically enhanced toys may be perceived as play machines, whether they are functional devices—such as mobile technologies—or actual toys. As such, they represent a branch of *playable technologies* that can also be addressed as *Head Up Toys* (HUTs).

Consequently, digital toys are not limited to screen-based interaction as they offer tangible interfaces (Sung, 2018). Playthings that afford ‘high touch’ (Naisbitt & Philips, 2001) also enable interactions beyond the screens. New playthings have evolved, using sensors, light, sound, and movement. Furthermore, sensors add to the interactivity by showing reactions to the player’s actions in the toy. These capabilities generate mental movement, or movement of the imagination, and physical or embodied movement of the toy.

Embodied features of toy robots with gender cues and as anthropomorphic containers include technical features like learning systems and sensors. Sensors can increase toy functionality and play value (Kudrowitz & Follett, 2014). Sensors allow the toy to know what is happening around it, and effectors allow it to respond to the environment (Pesce, 2000). For example, Kudrowitz and Follett (2014, 250) believe that sensors contribute to “personalized experiences that have the potential to positively impact cognition and behavior.”

Play machines of the current era are not limited to toys alone but demand an extended understanding of the embodied intelligent agents of today, like Alexa smart speaker (Druga et al., 2019). Artificial Intelligence (AI) applications, such as ChatGPT, which employs a generative language model to produce reactions to any

verbal prompt, clearly represent seemingly intelligent toys of our time. The connection of Artificial Intelligence becomes even more graspable when integrated into physical character toys such as dolls, action figures, and soft toys—or robotic pets. In these instances, the ethical implications and concerns surrounding AI-driven toys, such as the question regarding the perceived liveliness (and ‘liveness’) of these agents, become more prominent. Technologization has implications for the widening target groups. For example, AIBO is sold to adults (Pesce, 2000), and Thrift (2003) categorizes them as adult companions and status symbols. Indeed, so-called *kidults* represent an emerging consumer category for character toys (Heljakka, 2021).

Through robotics and interactive features, devices have become toys, and toys have become a technology that mediates various content. It is concluded here that play machines extend the scope of playful interaction regarding physical, cognitive, and emotional movement.

Artificial friends (AFs) merging toy robotics with artificial intelligence will have even wider capacities to urge players into various activities. Toys turned into robotic machines that are connected and intelligent and encourage physical, cognitive, and emotional movement call out for a more in-depth exploration of how players of different ages can form meaningful relationships with interactive devices, conceptualized here as play machines.

It is possible to envision how artificial creatures as play machines and playful agents could be used to influence children's cognitive and motor skills development, for example, through physical exercise. As presented through the play machines, the cultural and psychological aspects of play in the digital era seem to carry even more significance if they were intentionally used to train, for example, SEL (socio-emotional learning) and pro-social skills among players.

Some possible effects of consumer and entertainment culture on children's preferences and play habits have already been envisioned as part of *speculative toy fiction* (Heljakka, 2022), for example, in the popular movie *Ron's Gone Wrong* (Smith & Vine, 2021), in which friendship is built between a boy and a malfunctioning Internet-connected toy robot. As this example illustrates, relatability is intriguing, considering characters that function as play partners and combine the aspects of thingness, transmedia, and technology.

Play machines as invitations to ludic and paidic engagement

One of the other arguments presented here is that technological advances in toy design and the impact of this development in play machines significantly affect new play patterns. Back and colleagues (2017, 2) argue for the relevance of “understanding play as an activity, rather than games as artifacts and media.” Similarly, play machines invite player behavior that may affect learning and well-being in players of different age categories. This is to say that play experiences attained with the play machines may benefit humans in a life-wide and life-long meaning.

Toys introduce structure to play (Back et al., 2017), and technological augmentation enables more interactive affordances and toy features. Thrift (2003, 395) sees toys as “a gateway to the interactive world.” Digital games only “exist when enacted” (Galloway 2006, in Jagoda et al. 2018). Similarly, the interaction between players and interactive toys brings their digital affordances and features alive. Otherwise, they may be used as toys in traditional play. Engagement with this category of toys has physical, psychological, and sociological implications. For these reasons, it is argued here that the movement of interactive toys and robotics can move players in bodily and emotional ways, simultaneously increasing possibilities for players to learn from the toy engagements. Making new technologies available for children’s play enables and extends playful explorations (Yelland, 2015). For example, it is believed that playing with *phygital toys* (combining physical with digital) can prompt creative play patterns among players (Heljakka & Ihamäki, 2018).

Further, toys function in many ways, providing entertainment and learning possibilities. Many current toys include deliberately designed educational components that contribute to a conceptual understanding of them as a form of education or, as the term in educational research has been coined, *edutainment*. Educational technologies involve transmedia use for the sake of learning. Regarding toy-based learning (Heljakka & Ihamäki, 2018), this often means engagement with interactive ‘toy friends,’ in the name of playful learning.

The marketing strategies target children and parents—accentuating the educational aspect of interactive toys. Previous research interested in the educational potential of IoToys demonstrates how these play machines currently offer versatile edutainment opportunities through their interaction design—more precisely, their physical, functional, and fictional affordances. However, what remains scarcely researched are the affective and emotional dimensions of design

and use of IoToys. Still, some attempts to make recommendations for stakeholders involved in the design of play with near-future connected toys have been made, such as allowing multidimensional movement in play, considering socio-emotional learning, enhancing emotional skills, and promoting social sustainability (Heljakka, 2022).

Caillois' (1961) notions of *paidic* and *ludic* play are relevant concerning the toyification and gamification that have become visible in association with the emergence of play machines. Gamification has traditionally been associated with integrating gaming functions in devices not primarily designed for gaming use. Deterding and colleagues associate gameplay with using familiar elements from game design in non-game contexts (Deterding et al., 2011). As contemporary playthings, play machines relate to ludic gameplay, paidic toy play, and hybrid combinations of these two areas.

Today, gaming has expanded to include different products, applications, and services, as well as the use of different toys. To exemplify, Berriman and Mascheroni (2019) have similarly observed incorporating games and challenges into physical toy objects. A toy can inspire its players to interact, including game-like features interested in achievement, accomplishment, and goal-directed play. As such, toys have become vehicles for instrumentalized play, namely, play deliberately aiming at learning experiences. This development eases our way of thinking of toys as devices. The evolution of toys as a form of communication and education benefits from both open-ended and structured play patterns afforded by the play machines—by playing and playing *with* the machines, possibilities to learn and grow are borne from this interaction.

A helpful avenue to advance thinking of aspects of play machines is to consider them from the media literacy perspective. Media literacy involves a critical understanding of mass media, including their techniques and impact (Duncan, 2006). Technology can potentially teach children how to create, deconstruct, and understand various forms of literacy (Kirova & Jamison, 2018). Therefore, play machines may require an evolving toy literacy (Sutton-Smith, 1986). The literacy related to play machines—smart, interactive toys, connected IoToys, and companion robots includes the applications of digital play such as digital play environments and apps, digital games, and apps, which provide digital affordances and possibilities for ludic (structured) play, and traditional toys with multisensory affordances, which invite players to paidic (open-ended) play. When the play machines—smart, interactive toys, connected IoToys, or companion robots—suggest possibilities for game-like play, they point to the gamification aspect.

Conversely, when the play machines lean more on the qualities of traditional toys, this implies the toyification aspect (see Figure 2. below).

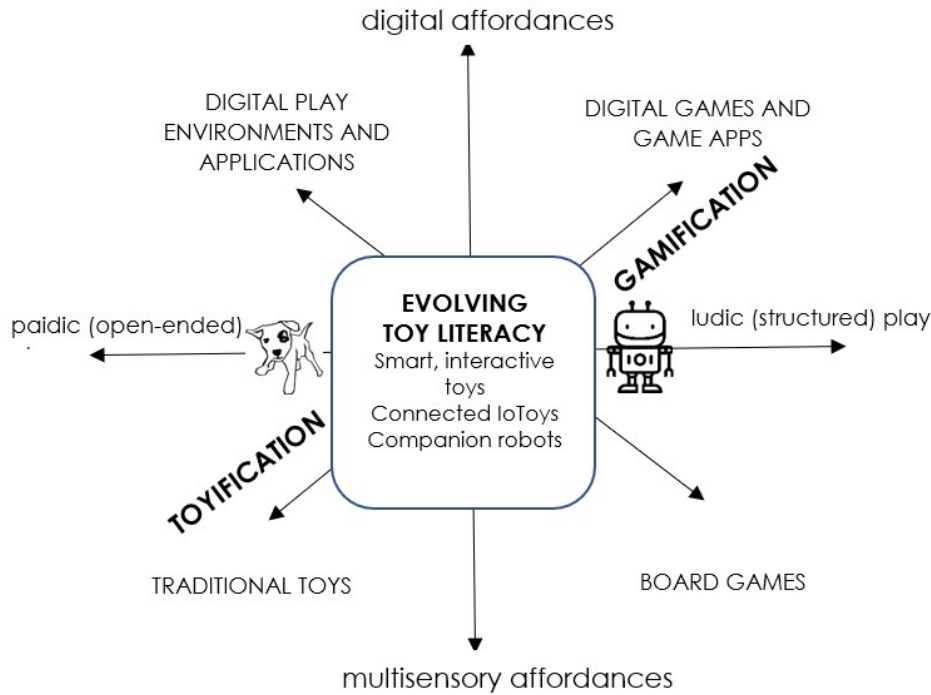


Figure 2. Evolving toy literacy: Applications, affordances, open-ended or structured play patterns, toyification, and gamification.

Conclusions: Implications of the evolving toy medium

This position paper has sought to explore the influence of current and emerging technologies on modern toys as play machines. As demonstrated, play machines, such as smartphones and tablets, are *technically toys*. Simultaneously, as current storytelling informs—both dystopian (*M3gan*) and utopian (*Ron's Gone Wrong*) toy narratives show how the categories of character toys—toys, dolls, social companion robots, and speculated future instances of Artificial Friends mutate and evolve. Blending the boundaries between three-dimensional, more traditional toys with digital devices conceptualized here as both digital toys and play machines extends, enhances, and enriches current play experiences (Heljakka, 2024). This evolution is in constant flux and adds complexities to notions of what a toy is and how forms of play—including physical and emotional mobility in play—unfold.

The evolution of the toy medium can be traced to three major trajectories that become perceivable in engagement with play machines. First, play machines can be

approached through the three-partite theoretical synthesis built upon the concepts of thingness, transmedia, and technology, as illustrated in Figure 1. In Figure 2, the author presents a tentative visual mapping of the areas of *toy literacy*, which can help to conceptualize how play machines could be explored from the perspectives of multisensory and digital affordances, toyification and gamification, and paidic and ludic play. This visualization lacks the dimension of evaluating the “liveliness” of the play machines and the effects of that quality for, for example, learning. Nevertheless, it is clear that the supposed “liveliness” impacts the reactions of human players to these artificial beings' invitations to play and may manifest as persuasion to physical movement or movement of the emotional kind. Finally, it is proposed that an evolving toy literacy is needed to critically evaluate the relevance of the play machines to various contexts where play takes place.

As technology continues to advance, we can expect even more innovative and immersive toy experiences in the future. The implications of play machines for the future of play and technological innovation are seemingly endless. They will become even more vast as AI unfolds as a tool and a possible companion, whose potential is unraveled in more ways than today. The prediction is that more fantastic character toys with abilities to move us beyond what has been discussed in this paper will emerge. At the same time, play patterns combining static and ‘traditional’ toys will be enlivened and made to move with the help of technologies that may not even exist yet.

Jagoda et al. (2018) observed that design may influence experience, but only indirectly. Nevertheless, explorations of the dimensions of play machines in the contemporary world and discoveries made in association with speculative toy fiction may point to directions of what is currently scarcely presented in conversations around toys. They could be improved in interactive artifacts in the intersection between toys, media, and technology. Toy designers must anticipate emerging technologies for future toys (Kudrowitz & Follett, 2014) as they represent, in the words of Pesce (2000, 6), “a sort of magical laboratory for the exploration of possibilities entirely beyond our abilities.”

The possibility of speculative cinematic fiction to portray affordances of future IoToys for motion and emotion through analyses of the popular animation film *Ron's Gone Wrong* (2021) featuring a fictitious internet-connected toy, a B*Bot named “Ron,” provides a new pathway to look at toy play of the future. Through investigations of “real” IoToys of present times and “Ron” as a portrayal of the possible IoToys of tomorrow, the study continues the work of the author (Heljakka, 2022) by positioning speculative toy fiction as a form of design fiction that allows

comparisons to be made between currently available and future toys and in this way, what is (and is *not*) desirable in smart toy friends of the future. How interactive toys, such as the IoToys, continue to merge with humanoid robots, such as Artificial Friends, and how this evolution may impact the landscape of post-digital play remain a challenge for further speculative toy fiction—and future toy design as well as toy research—to explore.

Recommendations for future studies and implications for policy and practice include perspectives gained by exploring the positive aspects of play machines, as approached in this position paper. Designers of new play machines may benefit from following guidelines in recent toy research associated with speculative toy fiction.

The final point this paper strives to make is to call attention to recent research (Heljakka, 2022; 2024), which suggests that the designers of interactive and connected toys and toy robotics would benefit from exploring the following design directions when bringing new and more sustainable play machines onto the market, for indoor or outdoor play, offline and online play, and for play of both children and adults, even intergenerational play practices. With these suggestions, I open the floor to future conversations on the design and applications of play machines—the character toys that move our bodies, minds, and hearts.

Design suggestions for designing future play machines include the following:

- Maximize natural interface
- Encourage age-appropriateness but create possibilities for broad user groups
- Enable possibilities for life-wide and life-long playful learning
- Design for adaptable, multifaceted educational value
- Provide fun, excitement, portability, and the ability to pose
- Facilitate social interaction through open-ended (toy-like, or paidic) and structured (game-like, or ludic) play
- Encourage collaborative and intergenerational engagement
- Enable personalized experiences
- Consider cultural diversity
- Ensure safety by keeping track of play data
- Enable open-mindedness to new play ideas
- Consider SEL, pro-social skill-building, and promoting sustainability
- Play-test before and after release with all possible stakeholders in play

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