Playful and Humorous Interactions in Urban Environments Made Possible with Augmented Reality Technology

Anton Nijholt(✉)

Human Media Interaction, University of Twente, Enschede, The Netherlands
a.nijholt@utwente.nl

Abstract. There is more to humor than jokes. Humor can be created in jokes, in cartoons and animations, in products, commercials, and movies, or in stand-up comedy. However, also during our daily activities, we often smile and laugh because we experience interactions and events as humorous. We can experience such events; we can also initiate such events. Smart environments offer us tools that allow the customization of urban environments to potential and personalized playful and humorous experiences. Sensors and actuators in smart urban environments can be addressed and configured in such a way that they initiate and facilitate playful and humorous events in the real world, but it is also possible that without physical changes in the real world, our imaginations are triggered to give humorous interpretations of events in the real world by observing or imagining how they could be different. In this paper, we look at humor that can be experienced by imagination, by suggestions, by changes in the environment, and by changing the environment using digital augmented and diminished reality tools. The views expressed here can help to add humor to urban play, urban games, and daily activities in public spaces using augmented reality technology.

Keywords: Humor · Incongruity · Play · Sensors · Actuators · Digital technology · Urban environments · Smart environments · Augmented reality · Diminished reality

1 Introduction

Humor is important in our daily lives. While on the street, using public transport, or driving cars, it is often the case that we become bored, irritated, or frustrated. Nevertheless, it is also the case that there are many situations in which we smile or laugh while interacting with others, at home, in our workplaces, or in public spaces. We also can be amused by perceiving unexpected events and by giving humorous interpretations to events, possibly drawing on our past life experiences. Maybe a bystander provides us with such a humorous interpretation. Maybe someone watches us when we smile without any understanding of why we do so.

In smart urban environments, we have sensors that monitor and interpret inhabitants' behaviors. Based on this context-aware measuring of an individual's behavior, other knowledge that is available from this inhabitant, and global knowledge about people's behavior and preferences, actuators can support city dwellers in their activities while, at the same time, all kinds of demands placed on residents can be met. Can smart urban technology help to add humor to serious and playful activities in urban environments? Can it add humor and playful applications to urban, location-based gaming apps [1]?

The interplay of sensors and actuators embedded in smart urban environments can lead to physical changes to these environments. Changes can be on visual displays, but there can also be changes that involve ambient light, sound, and scent, changes in the appearance of public spaces, buildings, and street furniture. Changes can be caused by people's behavior, traffic, dangerous situations or, perhaps, seeing the possibility to create a playful or humorous situation. Changes can also be initiated by city dwellers if they have access to the appropriate sensors and actuators. Apart from having authorized access to sensors and actuators in the urban environment, communities and individuals can introduce their own networks of sensors and actuators, and, of course, they can use and hack urban sensor and actuator networks for location-based gameplay, unauthorized interactive street art, protests, and activism.

The interplay of sensors and actuators can also lead to virtual changes in the environment. We can notice such Augmented Reality changes on our smartphone, a head-mounted device, or with our smart glasses. Again, such changes that are projected on a reality that is displayed on our smart devices can be initiated by a smart environment (controlled by companies and civic authorities) or there is the possibility to control this augmentation of reality ourselves. That is, having a city's authorized access to sensors and actuators that have been designed for that purpose, having access to sensors and actuators in a companies owned public space, introducing sensors and actuators that are meant to allow individuals or communities to develop their own desired applications or hack authorized applications in order to design Augmented Reality games, entertainment, and art. Or, as is the topic of this paper, use augmented reality technology to add playfulness and humor to our daily activities.

In the next section (Sect. 2), we provide some preliminary notes on perceiving play and humor. Play leads to humorous situations, but it is also the case that when in a playful mood, we can give humorous interpretations to particular events. Can we organize our daily behavior and our lives in a more playful and humoristic way by using smart technology? Traditionally, humor research has been about verbal humor. Therefore, in Sect. 3 we focus on humor as it can appear and be described in the physical world, particularly in urban environments. We discuss views on play and humor that fit in the same framework. Section 4 is about digital technology that is available for city dwellers and that can help to make smart environments more playful and humorous. This will be elaborated in Sect. 5, in which we discuss how augmented reality technology can generate opportunities for play and humor in urban environments. A short section (Sect. 6) of conclusions follows.

2 Perceiving Play and Humor

2.1 Introduction

It is interesting to make a comparison between how we perceive an environment from the point of view of play and from the point of view of humor. Our aim is not to discuss all characteristics of play and humor, how they are distinct, and how they relate. Rather we want to see how we can profit from exploiting similarities between humor and play in order to design smart technology in urban environments that supports playful and humorous events and interactions with these events for city residents and city visitors.

There have been many attempts to characterize play and humor. The benefits of play and humor have also been investigated [2]. Humor has been characterized by John Morreall as "cognitive play" [3]. There have been discussions about differences between humor and play, and Morreall's views on humor as play have been criticized [4]. Unfortunately, in these discussions, no clear distinctions between humor, play, and laughter are made. In play, humor is not a necessary condition: humor is not necessarily playful, and smiles and laughter do not necessarily express amusement. However, playful activities often lead to humorous events, to humorous interpretations of events, or to ways that events could be continued in a humorous way. Although the focus is on child's play, according to Elini Loizou [5], we can also learn when adults and older adults become involved in play: "during humorous events children are involved in play activity such as a) play with materials; b) play with language, c) pretend play; d) physical play, and these forms of play are then turned into humorous events due to the creativity that children exert during such activities. Also, children were involved in routines that they then turned into playful humorous events."

For the purpose of this paper, we focus on similarities between play and humor. Usually, we enjoy humor and we enjoy playing, but in order to enjoy them, we need to be in a playful state of mind (the so-called "paratelic state of mind") [6]. This state can be contrasted with the more serious, goal-oriented "telic" state of mind. In order to enter the paratelic state of mind, we need to feel safe and protected. This allows us to think and act in playful and humorous ways, that is, to assign additional, sometimes contrasting, interpretations to objects, interactions, situations, and events than we do in the telic state of mind. This can be done without fear of serious consequences.

Both humor and play assume that we can have different points of view about a real event, how we perceive it, and how we can change it or what we can add to it with our imaginations. How humorous would it have been if it happened in this or that way? We can add a humorous interpretation to a (playful) event and share it with others (friends, other players, bystanders).

2.2 Perceiving Play

We will first look at how we perceive an environment, its inhabitants, and its objects when we "play" it. There are some general observations that we should mention. In *Homo Ludens: A Study of the Play-Element in Culture* [7], the Dutch historian Johan Huizinga mentions the "magic circle," an arena, a playground, a temporary world with special rules but within the ordinary world. Some other characteristics of play that are mentioned by

Huizinga include that (i) it is voluntary, (ii) it is distinct from ordinary life, and (iii) it takes place within temporal and spatial boundaries. Whether or not these characteristics are always present in playful events in urban environments, they can be a starting point for distinguishing play from other activities that occur in urban environments. Before actual play, the magic circle is known or is created and agreed upon. It is where the actual play will take place. We enter the circle, and at a certain time, we leave the circle. In other research, the notion of the magic circle has been elaborated upon, and it has been given a more present-day interpretation [8].

Huizinga did not know about digital technology and how digital technology can augment a physical environment in such a way that (a) it allows access to play opportunities that cannot be realized and only can be imagined in the real physical environment, and (b) it allows us to integrate play with daily routines and other real-life activities; hence, no strictly defined boundaries (temporal and spatial) distinguish play from non-play. Hence, with digital technology, the circle becomes blurred. Pervasive games have been defined as having features that expand this circle of play spatially, temporally, or socially [9]. Although it is possible to start a discussion on the difference between play and games, here we follow these observations on games, and we assume we can learn from them. This is done even though play can be considered to be less restricted to the rules of the game than play, in particular, spontaneous play (that is, play in which rules are not given in advance and in which rules can change and be made up during play upon agreement with the other players).

In particular, the spatial expansion made possible by digital technology makes the whole world a playground. Wherever we are, smart technology knows where we are; it is aware of our context and what we know about our context. We can cooperate with our smart environment in order to create playful events and experience playful events created by our smart environment.

Yuri Lotman [10] provides a view on art and play that fits in our observations on interpreting an environment as potentially playful and humorous. Lotman does not mention humor; however, play and playfulness are among his main topics of observation: "Play is a model of reality of a special kind. It reproduces some of the features of reality by translating them to the language of its rules." Furthermore, "Play is the simultaneous realization (not their alternation in time!) of practical and conventional behavior. The player must simultaneously remember that he is participating in a conventional (not real) situation (a child knows that the tiger in front of him is a toy and is not afraid of it), and not remember it (when playing, the child considers the toy tiger to be a real one). The child is only afraid of the living tiger, the only thing he is not afraid of is the stuffed tiger; he is slightly afraid of a striped gown thrown on a chair and representing a tiger in the game, that is, he simultaneously is and is not afraid of it."

In play, we must give extra meaning to what we perceive. As mentioned by Lotman [10], "The mechanism of play involves not the static simultaneous coexistence of different meanings, but the constant awareness of the possibility of alternate meanings to the one that is currently being perceived. The play effect means that different meanings of the same element do not appear in static coexistence but 'twinkle.' Each interpretation makes up a separate synchronic slice, yet retains a memory of earlier meanings and

the awareness of the possibility of future ones." Hence, in play, according to Lotman, different meanings "twinkle."

2.3 Comparing Play and Humor from a Humor Point of View

Lotman's interpretation of play is not really different from what we see appear in humor definitions. Both in play and in humor, we allow different interpretations of what we perceive. In play, we give a different meaning and function than usual to objects, actions, and events. Often, the meaning plays a role in a "story" that is maintained. The creative use of an object can be seen as incongruous and even humorous by a bystander but not necessarily by the player or players during their play. However, as mentioned by Lotman, there is the "twinkling" of meanings, and in contrast to a situation in which only one meaning is available, this "twinkling" helps to provide a humorous view on a play activity. In "canned" play, as we know from jokes, pranks, and comedy, others have provided us with alternative meanings for what we other-wise would have considered objects, actions, and events with standard, stereotypical interpretations. In more spontaneous play, we do this assignment of alternative meanings ourselves.

Humor is also about having at least two different views on objects, actions, and events. Often, it is about opposing views. For example, in a joke, we are usually led to the belief that we have to deal with a stereotypical situation. A punchline then makes it clear that we completely misunderstood the situation. We can give it a different interpretation because of some additional information that became available from the punchline. When we interpret an object, an action, or an event as humorous, that is, it amuses us and/or makes us laugh, there is not necessarily this sequential change from one interpretation to another. We can maintain two or more interpretations. However, two or more interpretations do not make an object, action, or event humorous. Two different views experienced by the same person of what is happening in the real world is not necessarily amusing. The views can be slightly different. The environment or text may allow some ambiguity. For a joke to be humorous, we need to replace one, usually straightforward, interpretation, with a less stereotypical and unexpected one. In real life, this can also be the case, but there can also be situations in which we maintain two interpretations of an event simply because the event allows it (no additional information is provided) or the event has been designed in such a way that two or more interpretations remain possible. In humor theory, the assumption is that such different interpretations are humorous and are the object of a comic amusement emotion if they are sufficiently opposed. This contrast in interpretations does not have to do with additional information that makes us decide in favor of one interpretation above the other. There is no need to "resolve" an incongruity; the in-congruity is accepted and appreciated, and it amuses us.

In humor, we can be confronted with a situation that allows two or more conflicting or opposing interpretations. We are not necessarily aware of different interpretations; we just assume a stereotypical situation until additional information brought to us makes us aware of a possibly different interpretation. Especially in the case of jokes, it is customary that we ultimately decide about the correct interpretation, rejecting a previous choice by an interpretation that was not foreseen but was nevertheless plausible, in retrospect. In nonverbal humor (for example, in cartoons, in the sight gags of movies, or in real-life events), different interpretations can co-exist. There, we do not replace the first

interpretation with the next one but rather maintain more than one interpretation at the same time. In that case, different interpretations or meanings "twinkle," and when they are sufficiently opposed, they lead to amusement. There is no need to "resolve" an incongruity. In our minds, we can maintain opposing and therefore humorous interpretations of what we perceive or imagine during our activities in the physical world.

To summarize, in play, we assign different and unusual meanings to objects, actions, and events. These meanings are functional, that is, they are necessary to distinguish the role of objects and events in real life from the roles they have when children or adults make playful use of these objects and look at events from a playful point of view, rather than from a literal point of view. In (real-life) play, a shoe can serve as a goal post in a football match. There is no humor intended when such a choice is made. It may be different (and also amusing) for someone watching children play football. It can become comic, when, by accident, someone shoots the shoe into the goal. The shoe, which was made a goal post by the players' choice, has now become a football by accident.

Play usually assumes and requires assigning unusual meanings to objects and to unusual interpretations of behavior and events; play events can be distinguished from humor events because of the conscious meanings assigned to the objects, actions, and events we have in play, in contrast to the surprising and unexpected meanings we are triggered to assign to perceived objects and events in our environment that allow various and often opposing interpretations.

The next section provides more observations on humor from a humor research point of view. Where do our observations on humor come from, and can they be given a more formal, psychological, linguistic, and artificial intelligence research base?

3 More on Defining and Experiencing Humor

3.1 More Than Joke Humor

We can find linguistic answers to what humor is in research papers on incongruity in jokes [11]. Jokes are short texts that allow linguistic and common-sense analysis. Humor definitions that are based on jokes emphasize a common-sense interpretation of the set-up of a joke and a cognitive shift that is needed in order to understand the punchline, which contrasts our expectations and requires an interpretation that opposes our initial one. This linguistic analysis of jokes does not do justice to the true qualities of humor. Humor experiences in real life are not about jokes. They are about what we see and about our interactions with others. Non-joke humor appears in conversations, in observing and imaging events, and in friends that tell you about humorous events. Can we replace or add to such humor by introducing digitally created humor? Can we have digital, virtual, and personal agents that provide us with humorous interpretations of the situations we encounter? Or, can we have our personal and artificial agents tell us how to make changes to the environment in order to make it humorous to us or others?

Humor definitions are biased toward incongruity in jokes. Without going into details, we can say that in the setup of a joke, we are led to a stereotypical viewpoint. But additional information, for example, that provided by the punchline, makes us aware that the situation requires a different, usually less stereotypical, viewpoint. In fact, to be humorous, it has to be a viewpoint that opposes the original viewpoint. The punchline introduces

an incongruity that, however, is "solved" by our shift to the less expected viewpoint. That is, the incongruity was not there at all; there were two conflicting interpretations in the beginning, but only one survived.

Clearly, there are many other forms of humor than just joke humor. Verbal jokes provide us with a sequential change of interpretations. A first and obvious interpretation of an event has to be replaced by a second, less obvious interpretation. The second interpretation needs to be opposed to the first one in order to introduce comic amusement.

This incongruity viewpoint of humor does not exclude the superiority and relief viewpoints. The superiority viewpoint tells us that we experience humor when we can laugh about someone's stupidity. This stupidity can range from someone slipping on a banana peel to someone using illogical reasoning to come to a decision. The relief viewpoint tells us that we experience humor because it allows us to get away from the daily fuss. Topics and behaviors that are otherwise taboo can be expressed without being corrected. The incongruity viewpoint has been mentioned and discussed since the seventeenth century [12], and more than the superiority and relief theories, it tells us how to detect, analyze, and generate humor. We can say that the incongruity view is about the stimulus, the structure, and the mechanics of humor; the superiority point of view is about the social aspects of humor, and the relief point of view addresses the relaxation of tension, or, more generally, the release of suppressed feelings and the replacing of negative feelings with pleasant sensations.

The incongruity point of view tells us how to analyze and how to generate humor in jokes. In the literature, it has been generalized to the analysis of humor in cartoons, on stage, in TV series, in movies, and in real life. We can look at the humor definition provided by Noël Carroll [13], who has analyzed visual humor (sight gags) in movies [14] and therefore has a more comprehensive definition of humor than some other researchers. Carroll defines humor by introducing the "comic amusement" emotion, an emotion that has humor as its object. In more detail, someone is in the state of comic amusement when (i) the object of one's mental state is a perceived incongruity that (ii) one regards as non-threatening or otherwise anxiety-producing and (iii) not annoying and (iv) towards which one does not enlist genuine problem-solving attitudes (v) but which give rise to the enjoyment of precisely the pertinent incongruity and (vi) to an experience of levity.

It is clear that the core of the definition is the incongruity. An incongruity can be perceived, analyzed and designed. The other elements of the definition are about the effect on the recipient of humor. Other definitions of humor are available, but they focus more on humor that is expressed verbally, usually as it appears in jokes. Jokes are artificially constructed short texts; they certainly are not accountable for our everyday amusement and our smiles during our daily activities. Humor research has focused on such constructed jokes for the simple reason that more than real-life situations, jokes lend themselves to an analysis by techniques from linguistics and artificial intelligence, such as scripts, frames, and reasoning. Until now, this has not led to success, and it has been argued that in order for a computer to understand and generate humor it needs to be able to understand everything that can happen and imagined in the real world. Moreover, in the case of jokes, there are social interaction cues that make us aware that we should not take the next utterances seriously. This is quite different from humor that emerges during conversations or humor that is experienced during unplanned and incongruous situations

that we encounter in real life. We often smile and are amused while we interact with others, while we observe events, and while we imagine how things could be different from what we observe and how being in a playful mood allows us to provide a humorous interpretation to what we observe. This is "natural" humor, rather than humor that is "constructed" as it is in jokes, on stage, in cinema, in TV series, or in April Fools' Day pranks.

In a relaxed and playful state of mind, we are happy to consider different and contrasting perspectives on real-life events or situations. This cognitive play is the basis of incongruity humor [12], and we have to investigate how we can support this cognitive play with digital technology. But before being able to do so we need some better characterizations of humor in real life and how it differs from joke humor.

3.2   From Jokes to Real-Life Events

The phrase "You had to be there to know why it was funny" nicely makes clear that it is difficult to describe situations that make people smile or laugh. Actions, events, and comments on these situations may require extensive knowledge of their particular contexts for others to catch the subtleties that trigger amusement, smiles, and laughter. In "designed" jokes, cartoons, stage and movie performances, and comedy series on television, information can be concealed and revealed whenever it can be thought to have a humorous effect. The situations and events are controlled: the authors and directors decide what you see. A reader, a listener, or a viewer is provided with the designed context in which this designed humor is presented.

The real world offers fewer opportunities for designers of humorous events. Sometimes opportunities arise. A prank can be designed, but often there is an accidental coincidence or stupidity that leads to a humorous situation [15]. Can this change with digital technology? If we have access to sensors and actuators embedded in our home environments and in public spaces, can we use them to design humorous events? We have our smartphones, smart watches, smart glasses, and other wearables, including augmented reality devices, to make changes to the world we and others perceive. So, why not investigate how this technology can be used to design playful and humorous events, planned or unplanned, in the real world?

We can adapt the perceived incongruity point of view mentioned by Carroll. An incongruity viewpoint tells us how humor is designed. It provides us with some necessary conditions that need to be fulfilled in order to generate comic amusement. The superiority and relief viewpoints are important as well, but they do not address how we can create humor or how we can analyze and decompose a humorous event in terms of its components. And, in particular, Carroll's view is not biased towards jokes. In a traditional joke, during a short period of time we stick to a stereotypical interpretation of an event, while in the subsequent period of time we have to exchange that interpretation for another, less obvious, but more correct, interpretation. Carroll's more general definition does not does it exclude such a view, but, more importantly it does not require such a strict sequential view on interpreting humorous events and replacing a first interpretation by a second one. This allows two or more additional views on humor. One of them that is in real-life the first interpretation of an event can be humorous, while the second interpretation amounts to a stereotypical, maybe disappointing, one.

And, the second view, in real-life situations, as will be further elaborated below, there is not necessarily such a strict sequential change of interpretations. Two (contrasting) interpretations can be entertained at the same time or almost the same time. An event, whether it is spontaneous or designed, can trigger more than one interpretation. It is not important which interpretation occurs first in order to find the possibly contrasting interpretations humorous. It may also be the case that the perception of a stereotypical event immediately triggers a memory in which such an event turned into a humorous event. Hence, a different interpretation is there as well, not necessarily forcing another or first interpretation to disappear.

Obviously, in traditional joke research [11] we also have two interpretations of a text, we have the 'cognitive shift' that is involved in understanding the joke, and this cognitive shift can only be there when we are aware of two interpretations and have replaced a first interpretation by one that more fits the punchline that triggered the re-interpretation. We need to be aware of two interpretations, a previous and incorrect one and its replacement by a correct one, and we acknowledge our misunderstanding rather than keeping both interpretations alive.

Although there are not many humor researchers who have investigated humor in real-life situations, those who have done so focus on incongruous objects, actions, and events that lead to humor. How we can introduce humorous incongruities, using digital technology, in our daily and recreational activities? We have sensors and actuators in our domestic and public environments, we have sensors and actuators in our wearables. Can they support us in making objects, actions, and environments more playful and more humorous? Can digital technology help us create humorous incongruities that lead to amusement, that make us smile and laugh? Can digital technology nudge us to play in our urban environments?

These questions motivate us to take a closer look at some theories of humor that are not focused on jokes or sight gags. Obviously, it is possible to learn from theories about jokes and sight gags. They provide exaggerated examples of incongruities, and the events that are described or displayed are not completely unbelievable. However, in real life, we perceive incongruous events differently from how we experience verbal and visual jokes. Usually, these jokes are accompanied with indications that make clear that what we will hear, read, or see will be humor and is meant to amuse us. This is not necessarily the case with spontaneous and accidental humor. Nevertheless, can we generate humorous events in our digitally enhanced physical worlds, and can these humorous events become part of our daily lives and recreational activities?

3.3   Towards "Natural" Real-Life Humor

We appreciate humor that is generated spontaneously or occurs accidentally. Spontaneous humor requires a playful and creative mind that is able to provide an unexpected and contrasting interpretation to what is perceived and what others perceive. Accidental humor, of course, is not intended. The contrast between what was intended and what is really happening is humorous if these views are sufficiently opposing (a humorous incongruity).

A joke is based on an incongruity that is not really there. We need a second look and access to additional, usually sequentially presented information, that allows a cognitive

shift to understand that our biased and probably stereotypical viewpoint needs to be replaced by a less stereotypical and even a contrasting viewpoint to understand the joke. We are not happy when we are not able to make this cognitive shift. On the other hand, unlike what we see mentioned in most joke research, we enjoy a joke not because we get rid of the incongruity but because we accept and understand why we perceived an incongruity.

Various categories of incongruities have been introduced by humor researchers. Unfortunately, because of the vast interest in joke humor, these incongruity categories have not received much attention. And, of course, humor in real life is much more difficult to formalize and give an algorithmic explanation than humor as it appears in short texts that can be analyzed using a (computational) linguistic approach. Various typologies of incongruity have been introduced [16–20]. Incongruities can address language constructs, but often the categories that are distinguished are more general, dealing with issues such as language, logic, identity, and action [16], deficiencies, opposing interpretations, coincidences, appropriateness [17], and incongruities from a conceptual, attitudinal, behavioral, presentational, physical, or reality-shifting point of view [18]. Different kinds of incongruities are distinguished in products [19, 20], for example, a bathroom mat that seems to be made of eggshells, as well as in movies [14] and commercials [21]. Cross-modal incongruities (for example, unexpected, opposing auditory and visual information) have also been discussed [e.g., 22]. Many observations on these typologies and on perceived incongruities in the real world can also be found [12, 23, 24]. However, a comprehensive, systematic approach to incongruities is still missing.

Focusing on enjoying the existence of a particular kind of incongruity rather than on getting satisfaction from resolving an incongruity is our approach to understanding the humor in real-life situations. We once more emphasize that a real-life event can be perceived as humorous. We may find an event humorous because we do not have the history and the background that others have. Perhaps our beliefs about how things usually are, and how people behave and think, are different from others'. When observing a physical event, context plays an important role. Quite literally, a different physical viewpoint can provide an observer with a perspective on an event that opposes the perspective of others with different viewpoints.

LaFollette and Shanks [25] mention contrasting belief sets that we can have if there is enough appropriate "psychic distance" from the event. If we are in the earlier-mentioned playful or paratelic state of mind, this allows us a "comic distance." We can therefore appreciate contrasting views. We do not replace one set of beliefs with the other, but rather we oscillate between them: "This 'flickering' in the focus of attention—this active oscillating between these different but related belief sets—is humor. Humor is not something passively witnessed. Like thinking, it is something in which the subject participates. Thus, to have a sense of humor on a given occasion is to be disposed to engage in the activity of flickering between different patterns of belief" [25]. We can experience, provided we have this "comic distance," this "flickering" of beliefs while perceiving humorous events in real-life. We certainly experience it in TV sitcoms when a particular event is described by different witnesses: "Each redescription reflects the differing alternate perspectives—and hence patterns of belief—of the witnesses. The humor arises from the viewer's flickering between the various descriptions of the event. The viewer,

however, does not merely passively consider each alternative pattern. Rather she rapidly oscillates between them. This speedy and participatory flickering is the humor" [25].

A similar but more detailed analysis can be found in Apter [6]. As mentioned before and emphasized by Apter, a person has to be in a playful and not goal-oriented state in order to appreciate humor. Apter distinguishes between transition and non-transition humor. In both, we have two or more interpretations of a particular situation. In transition humor, we have a reversal from one interpretation to another. But, contrary to what is advocated by joke researchers, in Apter's view [26], (1) the reinterpretation of a situation does not replace the interpretation that had appeared to be correct; the new reality does not alter one's perception of the apparent or purported reality that was first created, and (2) the new perception must in some sense be diminished in value or importance relative to what was first assumed. We can say that the new interpretation augments the initial one.

Apter's view that the new perception must in some sense be diminished in value or importance relative to what was first assumed has not always been mentioned in such an explicit way by other humor researchers. However, it is in line with understanding humor from the earlier mentioned relief, superiority, and incongruity viewpoints, and in particular, the superiority viewpoint can be said to address this diminishment.

Some additional issues can be identified, such as the need for the interpretations to contain opposing elements (such as sacred/profane, poor/rich, intelligent/stupid, large/small, important/trivial, young/old, private/public), and the difficulty of comprehension and the amount of cognitive elaboration necessary for reinterpretation. This also appears in the previously mentioned definition given by Noël Carroll (Sect. 3.1).

In Apter's non-transition humor, different interpretations of an event are appreciated at the same time. One meaning can be at the focus of attention, the other at the fringe, but fringe and focus can fluctuate. There is awareness of both meanings at all times. This view can emerge in wordplay, in cartoons, in movies and commercials, and in humorous events in real life, either intended ("world-play" [24]) or accidental. We should mention that in this view we can also find an event humorous because it reminds us of a previous event, and we can find an event humorous because we can imagine how different it could have been. In such cases, we add information to the real world that is extracted from our minds. In non-transition humor, a level of amusement can be maintained for a longer time when incompatible or incongruous characteristics continue to play a role in a story, a movie, or in real life.

3.4 Reconsidering "Humor Versus Play"

In the previous sections, we provided a common view on play and humor using the theories of Lotman [10], Apter [6], and LaFollette and Shanks [25], together with some more recent views on humor (Carroll [13]) and many observations on incongruities in real-life, rather than just in jokes. In Lotman's views on play, the players give more than one meaning to the objects, acts, and events in the real world. The meanings "twinkle." There is the "ordinary reality" and a "fictional reality." Both realities appear at the same time, and players are aware of them. There is an oscillation between the interpretations they have assigned to the objects, acts, and events in these realities. Play happens in the mixture of the ordinary and the fictional reality. Humor can emerge if the oscillation is

between opposing interpretations. For an onlooker, a shoe that serves as a goal post can be humorous. For a child playing football, the shoe has two meanings, but a possible opposition between the two meanings is not relevant.

In Sect. 2.1, we mentioned the work of Elini Loizou [5] on play. Play often includes unexpected changes in events or nonserious social incongruities [27]. These incongruities that are experienced in a playful mood and in a "safe" situation are humor objects that elicit amusement and laughter. It has been argued [27, 28] that humor evolved out of play. These arguments also mention that laughter often follows from social play and facilitates playful interaction. Parallelisms of humorous activity and play activity have also been mentioned [5]. While in Loizou's experiments children rather than adults were involved, knowing about these and other yet-uninvestigated parallelisms between humorous and play activities can help us to decide where to look when we decide to create a (digital) humorous activity, a play activity, or other activities that take place in our current, digitally enhanced, real worlds.. Hence, from the view of digital enhancement, when someone plays with materials, we can focus on the incongruous use of materials. With physical play, or when routines turn into play, we can focus on incongruous actions or the use of objects. Attempts to play with language can be supported by suggesting funny words, sounds, or wordplay. "Pretend play" is also about actions, appearances, and the use of objects that have different meanings in real life and in play. Again, opposing interpretations can become humorous.

4 Digital Technology that Makes Urban Environments More Playful and Humorous

Ordinary reality can be made more playful and more humorous. In order to introduce playful or humorous events in a physical environment, we can make physical changes to the environment or assign unusual interpretations to objects, acts, and events in the environment. Real-life play and humor require assigning different and sometimes unusual interpretations to objects, acts, and views. Physical changes are not always necessary from a humor point of view. An event in ordinary reality can trigger more than one interpretation spontaneously. It is also possible that it triggers an earlier experience that we compare with the physical experience, possibly leading to a humorous view, or that it triggers our imaginations in such a way that we fantasize how different and humorous this event could have been. Hence, our imagination provides us with a humorous view on the event.

But what can be the role of digital technology in order to create playfulness and humor in urban environments? There are several options.

- Digital technology can help to make changes to urban environments that allow a chance of interpretation, including a humorous interpretation, of that particular environment or events taking place in that environment. Sensors and actuators can make changes to a particular environment and make it behave differently while its inhabitants interact with it. These digitally controlled changes include the introduction of physical changes. The simplest example is an automatic door that opens and closes because what it perceives through its sensors and what it controls through its actuators.

However, it is more interesting to look at the movements of robots and the use of smart materials or kinetic architectures. In particular, smart materials can be employed in such a way that objects and surfaces undergo unexpected changes in shape, size, or color [29], but an automatic door or an elevator can also be programmed to display unexpected and humorous behavior. Incongruous scents, feelings, or sounds can be added to objects and environments by using digital scent, touch, and audio technology.

- Digital technology can be installed in street furniture. Street furniture (for example, traffic signs, billboards, and public trash cans) can be made to interact with city dwellers in many humorous ways [1]. Smart street furniture can observe passers-by and comment on their behavior in humorous ways. This can be done in such a way that users are simultaneously persuaded to obey traffic rules, to stop smoking in public environments, or to buy a particular brand of shampoo.

- City dwellers often have digital wearables that make it possible to sense the urban environment, its objects, the events that take place in it, and fellow city dwellers. A personal digital assistant can be designed with a sense of humor. This humor butler observes what is happening in our environment and informs us about possible humorous twists to what it notices and what the user can or could have observed. The agent can focus on conversational twists, but it can also observe what is happening in the environment and comment on it in a humorous way, that is, in a way that attempts to add incongruous points of view to what is initially observed in the environment. The humorous views can be shared with the device's owner (assuming the owner is receptive to play and humor), and the owner, appreciating this humorous view, can also decide to share or, when appropriate, to realize this view.

Augmented reality (AR) is another digital technology that can be used to trigger playful and humorous interpretations of what is happening in an urban environment. Usually, an AR view provides us with a manipulated view of a physical environment. It overlays computer graphics onto the real world. Objects can be added, deleted, and replaced in the view that is presented to the AR user. Such a manipulated view can be experienced by using smart glasses, head-mounted devices, or smartphones. Virtual tactile and artificial scent augmentations of physical environments are possible as well, but these require different digital technologies. However, it should be clear that AR provides us with a technology that allows us to manipulate a real-world view in such a way that playful and humorous changes can be introduced or suggested. More explanation on this can be found in the next section.

5 Augmenting Reality to Facilitate Play and Humor

Examples of humorous situations that have been reported while gamers played the mobile AR game Pokémon GO have been provided [30]. Although Pokémon GO players can have humorous interactions with other players, these situations were not intended. They are examples of accidental humor that happens when players attempt to accomplish a gaming goal in the real world.

We may wonder whether we can increase the number of occurrences of accidental and unintended humor or the number of occurrences of intended humor with the help of

augmented reality. More generally, how can augmented reality technology be employed to make urban environments more playful and humorous?

AR technology has many useful applications: in workspaces, education, rehabilitation, advertisements, entertainment, games, and art. AR, as is clear from the previous sections, also allows us to design, create, and suggest playful and humorous situations for the AR user, who can use AR not only to experience but also to share and create playful and humorous events. There are various ways to experience humor in AR. We can have the AR displayed on our smartphones, on our glasses, or on our head-mounted displays. Other, less-researched methods are augmenting reality with scent, sound, or touch.

In AR, objects in real life are detected and recognized, information about objects can be displayed, and virtual objects can be added or can be used to hide detected objects behind newly introduced virtual objects. That is, real objects can be replaced by virtual objects. This certainly makes it possible to introduce non-existing incongruities in an AR view of the real world. Such incongruities can be introduced sequentially (the transition point of view mentioned by Apter). Hence, first we have a real-world view; next, we have the result of processing the real-world view and having it augmented with a contrasting, humorous view, or vice versa. From the AR point of view, we need to observe a particular situation and then decide about a possible playful and potentially humorous continuation that can be presented to the AR user. In the non-transition point of view, we can add, change or delete objects in such a way that the AR user is not forced, because of subsequent virtual information, to make a cognitive shift to a new interpretation but rather is triggered to entertain two or more interpretations of the augmented view at the same time. There is a "fluctuation" (Apter [6]), a "flickering" (LaFollette and Shanks [25]), and a "twinkling" (Lotman [10]) of interpretations.

We can, as mentioned in the previous section, also have a personal virtual jester that not only makes us aware of alternative views but also shows them. The AR system (or the virtual jester) needs to have a sense of humor in order to generate humorous AR views. We can accept a primitive sense of humor, for example, the jester just trying to generate contrasting elements in a scene maybe or learning from how AR users react. A jester's owner can decide whether or not to make use of its suggestions, share them, or implement them using his or her control of sensors and actuators in wearables and in the smart environment.

Obviously, AR humor can be designed and can be added to an AR application as canned humor. There can be humorous (incongruous) overlays. An example is the Burn That Ad app from Burger King. Mobile users can point their smartphone cameras to a McDonald's ad on a billboard or in a magazine and then, at in their smartphones, see this ad engulfed in flames and disappear to be replaced by a coupon for a free Whopper burger at Burger King. In another example, it can be humorous to see how a person tries to avoid a banana peel that has been added to the augmented world and is not present in the real world. Instead of adding objects to an environment, objects can be removed and a reduced (or diminished) reality displayed to a user. In that case, objects can be removed from a user's view. Removing a real manhole or a banana peel from a user's view can lead to a humorous situation. Obviously, the butt of a joke or the victim of a prank is not necessarily amused. Technical aspects, for example, "inpainting," of diminished reality

have been discussed [31, 32]. Real-time augmented and diminished reality allows magic [33], and magic introduces incongruities and inspires amusement, even if we are not able to resolve the incongruity.

There are more examples of AR humor, but why they are humorous is usually not explicitly addressed. In "Augmented Reality Art" [34], many examples can be found in which artists are using AR for provocative, entertaining, and humorous installations. Admittedly, this is about designed humor, but the examples may give rise to ideas about how to generate humorous situations by an AR system or have humorous views provided by an AR agent with a sense of humor (a personal virtual jester).

6   Conclusions

The aim of this paper is to show that AR technology provides opportunities to make life more playful and more humorous. In order to make that clear, we discussed some theoretical frameworks for play and humor and extracted some essential characteristics that can be addressed by AR technology. A "sense of humor" that has to be implemented in AR systems needs to know more about introducing humor than just arbitrarily augmenting the real world with contrasting objects, contrasting information about objects, or changes and replacements of objects. It requires that the AR system knows about context, how humor fits in this context and makes use of this context, and how, in the case of intended humor, it is signaled to its recipient of humor. We cannot expect that with the current state of artificial intelligence such a general goal can be achieved in the near future. Nevertheless, as has become clear from this paper, we can certainly use AR to introduce playful and humorous situations or potentially humorous situations in augmented views of urban environments.

References

1. Nijholt, A. (ed.): Making Smart Cities More Playable: Exploring Playable Cities. GMSE. Springer, Singapore (2020). https://doi.org/10.1007/978-981-13-9765-3
2. Bateson, P., Martin, P.: Play, Playfulness, Creativity and Innovation. Cambridge University Press, Cambridge (2013)
3. Morreall, J.: Humor as cognitive play. J. Lit. Theory **3**(2), 241–260 (2009)
4. Tapley, R.: On Morreall: a failure to distinguish between play and humor. J. Value Inquiry **47**(1–2), 147–162 (2013). https://doi.org/10.1007/s10790-013-9365-1
5. Loizou, E.: Humour: a different kind of play. Eur. Early Child. Educ. Res. J. **13**(2), 97–109 (2005)
6. Apter, M.J.: The Experience of Motivation: The Theory of Psychological Reversals. Academic Press, San Diego (1982)
7. Huizinga, J.: Homo Ludens. Routledge, London (1949)
8. Salen, K., Zimmerman, E.: The Rules of Play: Game Design Fundamentals. MIT Press, Cambridge (2004)
9. Montola, M., Stenros, J., Waern, A.: Pervasive Games: Theory and Design. CRC Press, Taylor & Francis Group, Boca Raton (2009)

10. Lotman, J.: The place of art among other modelling systems. Sign Syst. Stud. **39**(2/4), 249–270 (2011). Originally published in Russian as Лотман, Ю. М. Тезисы к проблеме "Искусство в ряду моделирующих систем". Труды по знаковым системам (Sign Systems Studies) 3: 130–145 (1967)

11. Raskin, V.: Semantic Mechanisms of Humor. Studies in Linguistics and Philosophy. Springer, Dordrecht (1984). https://doi.org/10.1007/978-94-009-6472-3

12. Nijholt, A.: "All the world's a stage": incongruity humour revisited. Ann. Math. Artif. Intell. **18**, 405–438 (2020). https://doi.org/10.1007/s10472-018-9609-7

13. Carroll, N.: Humour. A Very Short Introduction. Oxford University Press, Oxford (2014)

14. Carroll, N.: Theorizing the Moving Image. Cambridge University Press, Cambridge (1996)

15. Nijholt, A.: Smart bugs and digital banana peels: accidental humor in smart environments? In: Streitz, N., Markopoulos, P. (eds.) DAPI 2016. LNCS, vol. 9749, pp. 329–340. Springer, Cham (2016). https://doi.org/10.1007/978-3-319-39862-4_30

16. Berger, A.A.: An Anatomy of Humor. Transaction Publishers, New Brunswick (1993). First edition appeared in 1976

17. Morreal, J.: Taking Laughter Seriously. State University of New York Press, New York (1983)

18. O'Shannon, D.: What Are You Laughing At? A Comprehensive Guide to the Comedic Event. CIP Group, London (2012)

19. Yu, Y., Nam, T.-J.: Let's giggle!: design principles for humorous products. In: Proceedings of the 2014 Conference on Designing Interactive Systems (DIS 2014), pp. 275–284. ACM, New York (2014)

20. Yu, Y., Nam, T.-J.: Products with a sense of humor: case study of humorous products with Giggle Popper. Int. J. Des. **11**(1), 79–92 (2017)

21. Buijzen, M., Valkenburg, P.: Developing a typology of humor in audiovisual media. Media Psychol. **6**(2), 147–167 (2004)

22. Ludden, G.D.S., Schifferstein, H.N.J.: Effects of visual–auditory incongruity on product expression and surprise. Int. J. Des. **1**(3), 29–39 (2007)

23. Nijholt, A.: The humor continuum: from text to smart environments. In: Proceedings International Conference on Informatics, Electronics & Vision (ICIEV), IEEE Xplore, New York (2015). 10 pages

24. Nijholt, A.: From word play to world play: introducing humor in human-computer interaction. In: Proceedings of the 36th European Conference on Cognitive Ergonomics (ECCE 2018). ACM, New York (2018). Article 1, 8 pages

25. LaFollette, H., Shanks, N.: Belief and the basis of humor. Am. Philos. Q. **30**(4), 329–339 (1993)

26. Wyer, R.S., Collins, J.E.: A theory of humor elicitation. Psychol. Rev. **99**(4), 663–688 (1992)

27. Gervais, M., Wilson, D.S.: The evolution and functions of laughter and humor: a synthetic approach. Q. Rev. Biol. **80**(4), 395–430 (2005)

28. Weisfeld, G.E.: The adaptive value of humor and laughter. Ethol. Sociobiol. **14**(2), 141–169 (1993)

29. Nijholt, A., Minuto, A.: Smart material interfaces: playful and artistic applications. In: Proceedings 2017 IEEE International Conference on Imaging, Vision & Pattern Recognition (icIVPR), pp. 1–6. IEEE, New York (2017)

30. Andujar, M., Nijholt, A., Gilbert, J.E.: Mobile augmented games in playable cities: humorous interaction with Pokémon Go. In: Streitz, N., Markopoulos, P. (eds.) DAPI 2017. LNCS, vol. 10291, pp. 575–586. Springer, Cham (2017). https://doi.org/10.1007/978-3-319-58697-7_43

31. Hackl, A., Hlavacs, H.: Diminishing reality. In: Clua, E., Roque, L., Lugmayr, A., Tuomi, P. (eds.) ICEC 2018. LNCS, vol. 11112, pp. 28–39. Springer, Cham (2018). https://doi.org/10.1007/978-3-319-99426-0_3

32. Mori, S., Ikeda, S., Saito, H.: A survey of diminished reality: techniques for visually concealing, eliminating, and seeing through real objects. IPSJ T. Comput. Vis. Appl. **9**(17), 1–14 (2017). https://doi.org/10.1186/s41074-017-0028-1
33. Sakauchi, D., Matsumi, Y., Mori, S., Shibata, F., Kimura, A., Tamura, H.: Magical mystery room, 2nd stage. In: Proceedings of the International Symposium on Mixed and Augmented Reality (ISMAR), Demo (2015)
34. Geroimenko, V. (ed.): Augmented Reality Art: From an Emerging Technology to a Novel Creative Medium. SSCC, 2nd edn. Springer, Cham (2018). https://doi.org/10.1007/978-3-319-69932-5