

Chapter 3

The science of public health

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Introduction

In a book review by Paccaud (1999: 389) critiquing *The Potential for Health* by Kenneth Calman (former Chief Medical Officer for England), Paccaud was scathing about the significant lack of reference to bibliographic material, suggesting the lay public will be given *'the misleading impression that public health is much more an art than a science, a matter of opinion rather than a discipline of observation, analysis, and action'*. Paccaud's disdain for the 'art' of public health epitomises the perception that public health should be associated with scientific endeavour as the foundation of society's effort to address the biggest challenges linked to the health and wellbeing of the public (The Academy of Medical Sciences 2018).

The Science Council (2018) defines science as *'the pursuit and application of knowledge and understanding of the natural and social world following a systematic methodology based on evidence'*. Scientific enquiry covers a wide range of activities and demands exploration that is systematic and evidence based. As such, *science* enables verification and testing of concepts, facilitating peer review and critical scrutiny of the evidence being presented (The Science Council 2018). Science provides facts and figures that result in quantifiable evidence of efficacy – proof that interventions work and provide value for money, which is particularly useful in times of fiscal austerity. Play and playfulness comes in many differing forms, which results in difficulties isolating specific and measurable outcomes of the benefits play can bestow on individuals and society as a whole (Gordon 2014). This leaves play in a vulnerable position meaning play has been *'largely ignored'* by the majority of scientists studying and working in the realms of health and wellbeing (Gordon 2014). Gordon (2014: 234) asserts that *'the absence of play is a serious omission'*, particularly when the associated benefits can be linked to the natural sciences, social sciences, neuroscience, environmental science – in fact all the scientific areas that contribute to public health.

This chapter will explore the contribution that play and playfulness can make to the scientific pursuit of public health. It will demonstrate how play and playfulness enables engagement and collaboration, promotes innovation and curiosity and advocates for protection of environments that enable play endeavours to be pursued.

Background

Public health does not solely focus on the prevention and eradication of disease, rather, it is concerned with the whole breadth of health and wellbeing. The view that individuals are not only able to make choices about their health and wellbeing, but are also able to take control of the decision-making process, has been widely accepted for many years as being a central and fundamental component of health promotion (Downie et al 1996).

Approaches to health promotion have developed considerably in recent years, with a broad range of options being offered; for example, Scriven et al (2017) describe five models (Table 3.1).

Model	Focus
Medical	Health is defined as the absence of disease.
Holistic	This broadens the medical model to also incorporate the concept of positive health (in other words, the assets in people's lives that can potentially enhance their health).
Biopsychosocial	This also extends the medical model by including social, psychological and emotional aspects.

Ecological	This focuses on how individuals and their environments interact with each other.
Wellness	This has some similarities with the holistic model inasmuch as it focusses on positive health and the availability of personal resources (both physical and emotional).

Table 3.1: Five models of health promotion (Scriven et al 2017)

Despite the diversity of approaches, success has not always been achieved. For example, adult obesity levels have continued to rise in England (Health and Social Care Information Centre 2016). It could therefore be argued that there is a need to consider how individuals, groups and communities can be enabled to further engage with and contribute to the promotion of their health.

Playfulness is the *'predisposition to frame (or reframe) a situation in such a way as to provide oneself (and possibly others) with amusement, humor, and/or entertainment'* (Barnett 2007: 955); it is the ability of humans to be able to enjoy life (Yeu et al 2016). The need to engage and incorporate a playful and engaging approach is well established within childhood education; however, it has been suggested that play and playfulness can facilitate adult learning (Tanis 2012) and that it may have a positive impact on personal perceptions of wellbeing (Proyer 2012) and happiness (Yue et al 2016). For example, Li et al (2016) undertook a randomised controlled trial with 49 older adults who had a diagnosis of depression; the participants were in one of two groups to ascertain whether higher playfulness led to improvements in depression. The findings indicated that this was the case with playfulness (in this case Wii Sports games) impacting positively on feelings of emotional wellbeing.

There are opportunities to consider how public health, in particular, health promotion, may further embrace a playfulness approach. For example, the need to enhance physical activity levels for adults has been advocated for many years with guidelines (Public Health England 2016) suggesting that adults (aged 19-64 years) should undertake at least 150 minutes of moderate activity each week as well as exercises to strengthen muscles on a minimum of two days per week. Whilst there are some excellent and more traditional approaches available for adults to help them engage with physical activity (such as gym, swimming and walking classes), a more playful approach has tended to focus on children. However, adults can also benefit. Paul et al (2017) reported on STARFISH, a smartphone application [app] that was designed to increase physical activity in older adults who had survived a stroke. The app was developed to be used by groups of four people with each person being represented by a fish avatar. The fish appear in a tank on the 'wallpaper' of the smartphone; each time a person undertakes some steps, their fish swims in the tank and blows bubbles – in addition, the tail and fins grow. The app is able to keep a log of activity and also provide 'rewards' in the form of sea creatures that appear in the tank. The findings from the pilot indicate that the app was not only enjoyed, but provided social support, an element of competition as well as motivation for the users (Paul et al 2016).

Epidemiology

Epidemiology, which is the *'key quantitative discipline that underpins public health'* (Danesh 2018), has been defined as: *'the study of the distribution and determinants of health-related states or events in specified populations, and the application of this study to the prevention and control of health problems'* (Last 2001: 61).

One of the key roles of an epidemiologist is the promotion of public health via scientific enquiry and causal reasoning. Epidemiology focusses on the distribution of diseases as well the determinants of ill-health and the populations that are affected. For example, the World Health Organization (WHO) 2012; 2018a) has reported that approximately 60,000 preterm

babies are born in the UK each year, that is 7% of all live births (Office for National Statistics (ONS), 2015). Further scrutiny of the data (WHO 2018a) reveals that African countries have an increased incidence of premature births compared with most European countries; the UK itself has a slightly higher premature birth rate (with the Black Caribbean ethnic population having the highest incidence) than a number of its European counterparts (ONS 2015); this information helps health professionals to identify the particular areas of health service provision that may require specific attention.

Buck-Louis et al (2015) provide an overview of the continuing contribution epidemiology gives to public health; the authors highlight the research and development that has taken place in the key areas of cancer, nutrition, cardiovascular and infectious diseases as well as perinatal, occupational and environmental epidemiology. One area of health that remains a concern for the UK is that of obesity; epidemiologically focussed research can provide an invaluable insight into human behaviours. For example, Carreras-Torres et al (2018) undertook a Mendelian randomisation study using data from over 446,000 participants to ascertain whether those who have higher levels of body fat, BMI (body mass index) and waist circumference are more likely to smoke. The authors concluded that the results *'strongly suggest that higher adiposity influences smoking behaviour and could have implications for the implementation of public health interventions aiming to reduce the prevalence of these important risk factors'* (Carreras-Torres et al 2018:1). Other studies, such as that by Masi et al (2018) have indicated that those who have increased weight gain during their mid-thirties to early forties are more likely to have lower cognitive function in later years – meaning that BMI could be an indicator of future cognitive behaviour.

The insight that epidemiology provides cannot be under-estimated, it has a role to play in all aspects of public health, informing health priorities at local, national and international levels. Epidemiological data is widely available (from organisations such as the ONS, Public Health England (PHE), the WHO), it is therefore crucial that relevant information is accessed and appropriately drawn on by health professionals to underpin their practice.

Illustrative case studies

The remaining part of this chapter will provide a more detailed exploration of a variety of current *hot topics* causing significant concern to the public health community. These will demonstrate how three of the main pillars of public health activity (promotion, prevention, protection) utilize play and playfulness in synergy with scientific activity.

Overarching public health activity - Antimicrobial Resistance (AMR)

The pursuit of public health has historically evolved as the needs of society have changed (The Science Museum n.d.) with scientific and technological advances enabling deeper associations between causation and subsequent action to be made. It has been estimated that the development of antibiotic treatments has prolonged the life of every person on average by 20 years (Longitude Prize 2018a). However, the overuse of antibiotics has led to a global surge in anti-microbial resistance leading to untreatable infections that can affect any member of the global community at any time and in any place (World Health Organization 2018b).

According to the WHO (2018b):

'AMR is the ability of a microorganism (like bacteria, viruses, and some parasites) to stop an antimicrobial (such as antibiotics, antivirals and antimalarials) from working against it. As a result, standard treatments become ineffective, infections persist and may spread to others'

If action, which needs to occur on a global level, is not undertaken as a matter of urgency, the potential impact has been estimated at 10 million deaths per year from 2050, at a cost of £66 trillion to the global economy due to lost productivity (Public Health England 2017a). Described as an 'antibiotic apocalypse' and the 'end of modern medicine' (Public Health England, 2017b), efforts are now being made to raise awareness of the detrimental effects resulting from the overuse of antibiotics by health professionals and the public alike.

Conveying complex scientific messages in an engaging and entertaining manner means responsibility for the health of the global community can be shared and effective health literacy is a major part of the public health toolkit (Dinnen and Tonkin 2016). Visualizing the pathogens that cause infections and spread disease can be a useful way of raising awareness. GIANTmicrobes® manufactures over 150 different push toy microbes that are '*a million times the actual size*'. Each toy is scientifically based on an image of the microbe as seen under the microscope and can be used to open up potentially difficult conversations in a safe and supportive manner (Dinnen and Tonkin 2016).

Alternatively, the infection control team at the Evelina (Children's Hospital) London, which included a team member dressed as a giant microbe, provided games and information for young people to raise awareness of what can be done 'by all of us' to keep antibiotics working (Guy's and St Thomas' NHS Foundation Trust 2017). These activities coincided with World Antibiotic Awareness Week in November 2017 (WHO 2018c), which has become an annual event. Campaign materials made use of cartoon characters, including animated Graphics Interchange Format (GIFs) depicting people of differing ages and ethnicities, viruses, germs and faeces. Protection of the environment, preventing infection through good hand hygiene and promoting the need to listen to the advice of healthcare professionals before taking antibiotics are all featured messages, available for download from the WHO website as part of the effort to raise awareness (World Health Organization 2018d).

Public Health England (2017b) launched the 'Keep Antibiotics Working' campaign in 2017 in an effort to protect the public from antibiotic resistance and a future where antibiotics won't work when they are really needed. The campaign used humor as a means of engaging the public and included advertising, the use of social media and partnership working with pharmacies. Imagery within the campaign focused on red and white pills (Figure 3.1), who sing in a very short TV advert, using engagement techniques linked to advertising jingles:-

'Antibiotics - we're wonderful pills
But don't ever think we'll cure all of your ills
So every time you feel a bit under the weather,
Don't always think we can make you better.
Take us for the wrong thing – that's dangerous to do,
When you really need us, we could stop working for you,
So please don't end up paying the price,
Always take your doctor's advice'.

(Reproduced with kind permission from Public Health England n.d)

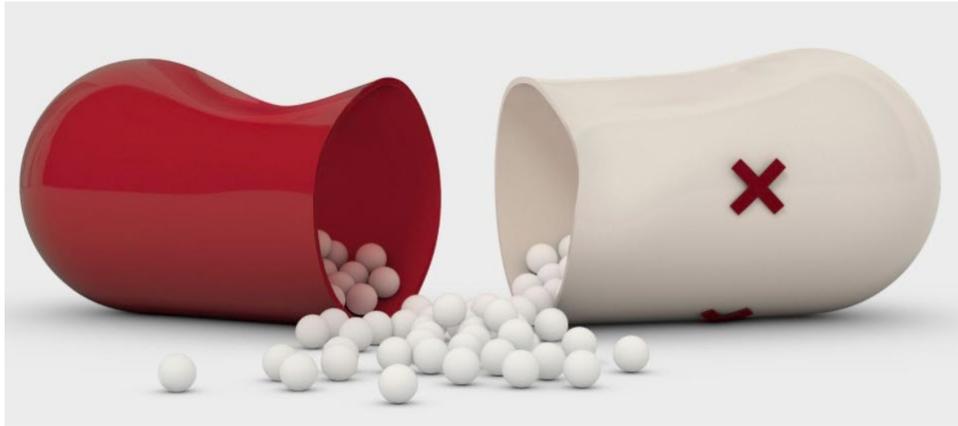


Figure 3.1: 'Keep Antibiotics Working Pill' (reproduced with kind permission from Public Health England 2017b)

Playful creativity breeds novel approaches to engaging the public and games *'can be especially effective to convey scientific content, sometimes even contributing to scientific research'* (Longitude Prize 2018b). Games provide a powerful tool for engagement with complex messages (University of Plymouth 2016), enabling people to modify behavior when awareness of important issue is raised (Gill 2017). With the advent of modern technology, games have the potential to reach a mass audience through gaming platforms, the internet and mobile devices. This potential is being embraced by game designers who, in 2016 identified antibiotic resistance as the core theme for a Games Jam Event – *Games for Better: A Games Jam on Antibiotic Resistance* (Gill 2017). Games Jams bring game developers together for a short period of time – in this instance 48 hours - to develop games from 'concept to implementation' (Gill 2017).

Although the main cause of antimicrobial resistance has been identified as the over use of anti-microbial agents (WHO 2018b), Shaw (2016) suggests that the basics in terms of *'breaking the chain of infection'* that originated in public sanitation measures many years ago, have been forgotten. New efforts are needed to re-engage society with simple strategies such as hand washing to reduce the transmission of disease, (as discussed in chapter 8) which could stop infections starting in the first place (Shaw 2016). The same message was being promoted just under 100 years ago, when Winslow (1920: 26) described *'the teacher of personal hygiene...as a supremely important factor in the present-day campaign for public health'*.

The National Institute for Health and Care Excellence (NICE) have published guidance advocating the importance of teaching all children and young people good hand hygiene and how to manage some common infections themselves (Regis and Stone 2017). NICE have endorsed a teaching tool called 'e-Bug', which is an educational software package featuring interactive games for children that are differentiated according to age/stage developmental levels (Regis and Stone 2017). Developed by Public Health England, e-Bug features a range of games that are used to teach the core messages around effective personal hygiene, useful and harmful microbes and the importance of finishing a course of antibiotics. There is also a six week community course for those delivering the e-Bug programme within community groups and settings called 'Beat the Bugs Train the Trainer', which promotes *fun* as a key component of each training session (e-Bug, 2017).

Promotion - Salutogenesis

Antonovsky (1979) coined the term *'salutogenesis'*, deriving it from the Latin *'salus'* meaning health, safety, wellbeing, and the Greek work *'genesis'* meaning origin – in other words the

'origins of health' (Antonovsky, 1996: 13). Antonovsky (1996: 11) thought of salutogenesis as a 'more viable paradigm for health promotion research and practice' than the 'disease orientation' since it focuses on 'moving people in the direction of the health end of a healthy/dis-ease continuum'. Antonovsky (1996) believed that there was the potential to enhance the health of *all* people, irrespective of their current health status, suggesting that the focus of health promotion should be on the whole person rather than their specific disease (or their risk of acquiring an illness). Antonovsky (1987: 13) commented that if he had to identify the most important aspect of salutogenesis, he would say that it *'not only opens the way for, but compels us to devote our energies to, the formulation and advance of a theory of coping'*.

Antonovsky (1996) suggested that there are resources that are available for use by people to enable them to cope with stressful situations, referring to these as general resistance resources (GRRs). GRRs cover a range of biological, material (such as money) and psychosocial factors and were developed from his personal previous work as well as earlier research that he had undertaken with colleagues (in particular a study that investigated how women from different cultures coped with the stress of the menopause (Datan et al 1981).

The identification of the GRRs led Antonovsky (1987) to propose the Sense Of Coherence (SOC), which views the world as *'comprehensible'*, *'manageable'* and *'meaningful'* (Antonovsky, 1996: 15) as shown in Table 3.2). Antonovsky (1987) suggested that a SOC is a major determinant of maintaining one's position on the health/dis-ease continuum and of movement towards the healthy end of it. A strong SOC enables a person to respond flexibly to demands. According to Antonovsky (1987) the SOC develops during childhood, adolescence and adulthood. Antonovsky (1987) commented that even in the best possible scenario, the adolescent can only have developed a SOC that is tentatively strong – it is the beginning of adulthood in which the SOC becomes established, being more difficult to influence at a later stage. The development of a weak or strong SOC is dependent upon a range of factors including social circumstances, socialisation within the family, gender, genetics, ethnicity and chance (Antonovsky 1996). It is therefore important to create an environment in which children and young people experience consistency, can recover from stress with appropriate support, and can participate in decision-making processes.

<p><i>Comprehensibility</i> The extent to which sense/order can be drawn from the situation, ability to process both familiar and unfamiliar stimuli.</p> <p><i>Manageability</i> Resources may be multi-faceted and include friends, family, God and colleagues.</p> <p><i>Meaningfulness</i> If a person with a high degree of meaningfulness faces a difficulty, they may not be happy about it, but they are willing to face the challenge. In practical terms, the person with a strong sense of coherence will:</p> <ul style="list-style-type: none"> • Believe that the challenge is understood (comprehensibility); • Believe that the resources to cope are available (manageability); • Be motivated to cope (meaningfulness).

Table 3.2: Central components of a sense of coherence (Antonovsky 1987; 1996)

The value of a salutogenic approach to health has been highlighted (Garcia-Moya and Morgan 2016; McCuaig et al 2018). In addition, there has been recognition of the value of adopting a salutogenic perspective in terms of outdoor space in healthcare settings (Bengtsson and Grahn 2014); other authors (such as Buck et al 2015; Koohsari et al, 2015) have alluded to the salutogenic effect of undertaking physical activity within green space.

Miller et al (2014) reported on the Scottish Government's *GreenHealth* project which examined, via a wide range of data collection methods, the relationship between green space and health within Scottish urban areas. The findings revealed that the availability of green spaces and open areas positively influenced health and wellbeing, promoted physical activity, mental and social health and reduced health inequalities. Miller et al (2014) provided specific examples of how green space was enjoyed:-

- For children, it was a place to play with friends and an area where they were able to take advantage of the natural environment (the trees, bushes, fishing in the burn)
- The peace and quiet associated with the green space was appreciated by both adults and children. It was a great environment to meet friends, enjoy physical exercise and to walk their dog

The playfulness and enjoyment that emerged from the study was evident. Miller et al (2014:33) suggest that the '*results mark a step forward in our understanding of possible mechanisms behind any salutogenic green space effect*'. The salutogenic approach has the capacity to be aligned with playfulness in other areas of health; by maximising general resistance resources (such as friends, family, pets, organisations) people can be encouraged to enjoy activities in a range of circumstances along the health-illness continuum – the elderly lady with dementia can, for example, spend time enjoying bingo at a lunch club, thus lessening feelings of social isolation and promoting a more positive quality of life.

Prevention - Bullying

The UK government (Gov.UK 2018) have stated that, in terms of the law, there is no definition of bullying; however, they suggest that there are normally three key factors and that bullying is usually:

- Recurrent;
- Intentional
- Frequently aimed at particular sectors of society – this could be, for example, related to faith, culture or sexual orientation.

Bullying is usually categorised into four groups: verbal, physical, relational and cyber, and the NSPCC (2018) suggest that it can include a wide range of activities (Table 3.3):

- | |
|--|
| <ul style="list-style-type: none">• Verbal language• Non-verbal messages (could be via text or using inappropriate hand/finger signals)• Behaviour that could be perceived as threatening or intimidating• Excluding someone from activities or socially isolating them• Trying to control someone• Continually criticising someone• Bullying that is racial, sexual or homophobic• Physical activities towards someone• Online activities• Anonymous or hoax phone calls |
|--|

Table 3.3 Activities associated with bullying (NSPCC 2018)

Traditionally, bullying has been associated with school-aged children and young people, with several studies focussing on this group (for example, Chester et al 2015, 2017). However, it is now recognised that bullying can affect a wide range of people, with research highlighting bullying within British hospitals (Carter et al 2013) as well as the wider workplace (Rodríguez-Muñoz et al 2010).

There is evidence to suggest that bullying can have long-term negative consequences that can impact on the health and wellbeing of those affected – both victims and perpetrators (Quinn and Stewart 2018) hence, bullying has become a public health matter (Anthony et al 2010). It has been suggested that bullying can result in physical symptoms, such as headaches (Due et al 2015), bed wetting and stomach-aches (Fekkes et al 2006) as well as mental health problems such as depression (Bowes et al 2015). In addition, bullying has been linked to unhealthy behaviours, for example, smoking (Vieno et al 2011) and alcohol and drug use (Quinn and Stewart 2018).

As a result of the potential and actual health problems, a range of strategies have been employed to both reduce bullying and to also assist with the reporting of it – hence protecting those at risk and preventing its manifestation. Health protection aims to make healthy choices easier, but it also recognises the influential socio-economic factors that can impact on the promotion of health. One of the core aspects of health protection is to enhance empowerment so that people feel that they are in control of their lives and can make appropriate decisions (Whiting and Miller 2005). For example, GOV.UK (2016) raised awareness of an app that was supported by Government funding; *Tootoot* (2018) is a platform that facilitates the reporting of bullying by children and young people via the use of screenshots of social media, twenty-four hour support is available for those who are the victims of bullying. In addition, resources such as *The Anti-Bullying Game* (Steng 1996) have been specifically designed for children and young people to aid their understanding of some of the factors that underpin bullying; the board game aims to facilitate discussion within a 'safe' group.

It has been suggested that more creative strategies can be beneficial in terms of detecting bullying. Álvarez-Bermejo et al (2016), following initial data collection, designed a mobile 'phone app that involved both students and teachers'. The app (PREVER: Prevention of Racial Stigma) was designed for young people under the age of 16 years and specifically focussed on the identification of racially-based bullying through the use of gamification; when a student interacted with the app game, s/he was both part of it as well as being a player. All of the students in a class had the app and all of the classmates were real, however, the interactions that resulted were not actual ones (they were simply part of the game) – this meant that the students were able to appreciate and reflect on their actions towards others. The authors gave the example of a game of football, with the app allowing a student to exclude people from a team – this rejection was recorded (along with all the other interactions performed). Teachers were able to access the recorded data, detect racial bullying and appropriately address it. Álvarez-Bermejo et al (2016) commented that the app game was particularly beneficial for the young people who were over 12 years of age.

Many anti-bullying initiatives have focussed on more traditional education approaches, for example, school-based student and teacher training programmes, peer-to-peer anti-bullying ambassadors and helplines – all of these are to be applauded and offer an enormously positive contribution to the anti-bullying agenda. However, creative approaches such as the PREVER app can augment these mainstream strategies by offering alternative methods of engagement that are protective, empowering, facilitate self-reflection as well as having the potential to identify inappropriate discriminatory and/or bullying behaviours.

Protection - Topophilia

The National Trust is a conservation charity that is independent of Government which, more than 120 years after it was founded, cares for over 600,000 acres of countryside, 775 miles of coastline and hundreds of special places across England, Wales and Northern Ireland (National Trust 2017: 43). A few years prior to the founding of the National Trust in 1895, the co-founder Olivia Hill described the founding principles of the National Trust, namely: -

'We all need space; unless we have it we cannot reach that sense of quiet in which whispers of better things come to us gently... places to sit in, places to play in, places to stroll in, and places to spend a day in' (National Trust 2017: 27). Hill (cited National Trust 2017:3) went on to describe that *'...the need for quiet, the need for air, and I believe the sight of sky and of things growing, seem human needs, common to all'*. The National Trust (2017) suggest that the human need to engage with such places aligns with the concept of topophilia (Greek *topos* – 'place' and *philia* 'love of') which describes the 'visceral but intangible feeling' of the attachment we have to places.

There is significant qualitative evidence that supports the need for humans to engage with nature and the natural world, as shown in Figure 3.4.



Figure 3.4 Early connections with meaningful places protected by the National Trust

Marmot (2010: 24) recommended that access to and improvement of the availability of *'good quality open and green spaces across the social gradient'* should be integrated into policy to reduce health inequalities.

However, scientific evidence is still considered to be the 'gold standard' when it comes to defining efficacy (The Science Council 2018). This point has been recognised by the National Trust (2018) who state *'we've always believed that natural and historic places have a powerful effect on all of us. Now, for the first time, there's scientific proof'*. With the advent of new imaging technologies such as functional Magnetic Resonance Imaging (fMRI) scientific evidence to support tacit knowledge is becoming more prevalent and the National Trust (NT) used fMRI as part of a major research project *Places that make us* that was published in 2017. Using a triangulation approach, the research consisted of three strands:-

- fMRI scans of 20 volunteers visualising areas of the brain associated with processing emotional responses
- Qualitative in-depth interviews with 11 members of the public (members and non-members of the National Trust)
- Quantitative survey with over 2000 respondents

One of the most important findings was that images can elicit strong emotional responses to places that have personal meaning to people, even to those who may no longer be able to visit their meaningful place, images can be used to generate feelings of connection, peace and belonging, all of which contribute to the protective mechanisms associated with emotional and mental wellbeing (National Trust 2017). Ultimately, the research was undertaken to demonstrate the importance of the work that is undertaken by the National Trust (2017: 43) to protect and preserve our national heritage. With over 5 million members and 620,000 volunteers and 22 million visitors each year, the National Trust has provided a scientific research base can also be used as a powerful means of advocacy, if government policy potentially threatens access to and enjoyment of urban or rural places that hold meaning to people and their significant others.

Conclusion

Public health *is* dependent on the wide ranging forms and functions of scientific endeavour for securing health and wellbeing for every member of society at an individual, local, national and international level. Scientific enquiry has historically relied upon the integration of quantifiable evidence that arises from systematic, methodologically defined exploration. This has meant the contribution of play and playfulness, which often falls beyond the parameters of measurable outcomes, has largely been ignored by the scientific community. However, with the advent of new technologies and an appreciation of how play based strategies can be used as a means of facilitating participation and engagement with the public health agenda, play and playfulness have an important contribution to make to the science of public health as noted by Brown (2008) who simply states: -

Science + Play = Transformation

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