1 **Title: SOUVENIR AUTHENTICITY IN THE ADDITIVE MANUFACTURING AGE**

2 **Keywords:** authenticity, souvenir, materiality, aura, 3D printing, authentication, digital fabrication

3 *"Authenticity doesn't just mean reliving the past: it means using it to find new ways of living maybe even*
4 *new kinds of progress. The most authentic isn't necessarily the most true to the past; it could be the most*
5 *creative or the most human" (Boyle, 2004, p. 44).*

6

7 **INTRODUCTION**

8 Souvenirs may function as memory cues and simulators of nostalgia (Belk,1988), expressions of
9 self and individuality (Decrop & Masset, 2014), identity (West, 2000), as well as a means of
10 conforming to group norms (Baker, Schultz Kleine & Bowen, 2006). They are both metonymic and
11 metaphoric, referring to the ritual of tourism, the collective narratives of the tourists and their
12 personal experiences (Rickly-Boyd, 2012, p. 285). They act as tangible evidence of a visit, enabling
13 visitors to relive an experience and retain the memory of a special occasion and location. Souvenirs
14 may be craft items, which are perceived as being artistically superior and more accurate reflections
15 of local art (Cave & Buda, 2013; Hitchcock, 2013), or mass-produced items that are commonly
16 described as cheap, meaningless, inauthentic objects (Norman 2004). Markers of authenticity
17 determine whether tourist souvenirs accurately represent local culture (Littrell, Anderson & Brown,
18 1993).
19
20 The search for authenticity, expressed as "an obsession with certainty – specifically, certainty as to
21 the origin, date, author and signature of a work" (Baudrillard, 1968, p. 81) defines the modern world.
22 For others, authenticity is the result of social construction, not an objectively measurable quality of
23 what is being consumed (Wang, 1999), or it is associated to the state of being (LaSusa, 2007). The
24 permeability of digital objects (Belk, 2013), and the advent of additive manufacturing (also known as
25 3D printing), as a mode of reproduction further blur the boundaries 'originals' and 'replicas' and
26 consequently, challenge current discourses regarding the authenticity of objects (Perkins-Buzo,
27 2017).
28
29 This paper considers how the creation of artefacts using additive manufacturing may impact the
30 consumption of tourist souvenirs. Drawing upon design and tourism literature, and findings from an
31 empirical study of visitor perceptions of 3D printed souvenirs within a heritage site, we assert that
32 additive manufacturing may transform mass (re)produced souvenirs into important, multi–faceted
33 and emotionally imbued objects. As such, the paper contributes to the expansion of scholarship and
34 theories that consider the values and authenticity of tourist souvenirs, as well as expanding the
35 theorisation on the meaning of 3D printed objects.
36
37

38 **SOUVENIRS AND AUTHENTICITY**

39 For the purposes of this research, 'souvenir' is defined as an object purchased to memorialise the
40 tourist visit, to evoke memories and emotional associations to the place and people visited, and the
41 feelings that were experienced (Norman 2004; Swanson & Timothy, 2012) long after the visit has
42 taken place. Souvenirs can be 'material and mental', of 'substance and essence' (Goss, 2008), and
43 possess 'memory cueing' characteristics. What constitutes an authentic souvenir remains an
44 important question in souvenir literature.

45 According to Jones (2010), the search for authenticity harks back to the dawn of industrial society,
46 which ushered standardised, mass production and the loss of craft, and gave rise to singularity as a
47 cherished quality. Influenced by Marxist theorisations, which purported that the capitalist mode of
48 production had alienated the individual from the product and process of their labour (Xue, Manuel-

Navarrete & Buzinde, 2014), Benjamin (1968, p. 3) claimed that whereas crafted objects had 'aura', the act of mechanical reproduction had detached the object from the domain of tradition (Benjamin,1968, p. 4) and had separated its spiritual from its material dimensions (Goss, 2008). He defined aura as 'that which withers in the age of mechanical reproduction' and argued that aura is embedded in ritual and the cult value of the object (Benjamin,1968, p. 4). "The aura is made up of (at least) two components: knowledge and belief about the object's social context and provenance, and the physiological (sensorial presence) impact of the actual artefact" (Bakker, 2018, p. 24).

For Benjamin, (1968, p. 4) the authenticity of a thing is "the essence of all that is transmissible from its beginning, ranging from its substantive duration to its testimony, to the history it has experienced" and "the presence of the original is the prerequisite to the concept of authenticity". "Even the most perfect reproduction of a work of art is lacking in one element: its presence in time and space, its unique existence at the place where it happens to be". "The object's historical testimony rests on its authenticity and when the historical testimony is affected, it jeopardises the authority of the object". Authenticity, thus, sought to establish that "objects are original, real, and pure; they are what they purport to be, their roots are known and verified, their essence and appearance are one" (Lindholm, 2008, p. 2). As such, it was linked to truth; and the axiom that it was possible to obtain externally verified, official accounts of the originality and value of objects.

In the tourism sphere, MacCannell (1976) posited that tourists seek authenticity in their attempt to evade the alienation they experience in their everyday home/work environments. The interconnections between authenticity and alienation have been less acknowledged within tourism scholarship (see for instance, Xue et al., 2014; Vidon & Rickly, 2018) and, as in our project, not yet explored as driving forces of souvenir consumption. We argue however, that Benjamin's approach to authenticity remains a useful lens for researchers in tourism (Boyd-Rickly, 2012; Lovell & Bull, 2017) and design (Perkins-Buzo, 2018) to also conceptualise the nature and qualities of digital and 3D printed souvenir objects. The rest of the literature review summarises existing theorisations of souvenir authenticity for physical objects and digitally created souvenirs.

Craft and Mass-produced souvenirs

The use and transformation of traditional, crafted items as tourist art to satisfy visitor preferences and their associated cultural assumptions (Swanson & Timothy, 2012; Torabian & Arai, 2016) became symbolic of tourism's increasing industrialisation and commodification (Cave & Buda, 2013; Hitchcock, 2013). Whereas craft souvenirs had originally contained qualities of workmanship (Littrell et al., 1993), 'natural' materials (such as wood or metal) (Kälviäinen, 2000), and traditional designs (Cave & Buda, 2013) in the 1960s the emphasis of souvenir production shifted to quantity and ease of reproduction. Unique designs were compromised in favour of visitor stereotypical images (Timothy, 2005), and souvenirs were scale adjusted and constructed with lighter materials to allow for easier transfer (Hitchcock, 2000). In this process, the craft souvenir lost its cultural meaning and its authenticity (Swanson, 2013) as an object that represented the local culture. With the onset of mass tourism, in a similar vein to the Benjaminian perspective, tourist souvenirs lost their authenticity.

Authenticity certificates, endorsed designs and seals of approval were used to determine authoritatively the souvenir items that possess objective (object) authenticity (Belhassen, Caton & Stewart, 2008; Lau, 2010), and to distinguish and elevate certain items above others. This process of 'cool' authentication (Cohen & Cohen, 2012) was typically "a single, explicit, often formal, or even official, performative (speech) act, by which the authenticity of an object, site, event, custom, role or person is declared to be original, genuine, or real, rather than a copy, fake or spurious" (Cohen & Cohen, 2012, p.1298). Craft items were considered more reflective of local culture than items that are symbolic shorthand, mass-produced elsewhere and imported to be sold at the destination. Mass-produced, low-cost souvenirs were denounced as plastic "kitsch" (Norman, 2004; LaSusa,

1 2007) because they did not possess the embedded history of the original object they represented or
2 could not evidence the human touch of a traditional maker.

3 Other researchers considered the significance of a souvenir to the visitor rather than authenticating
4 its objective value. Visitors cherish souvenirs that are symbolic shorthand (Gordon, 2004) of the
5 destination culture, as they display their understanding and stereotypical perceptions of said culture
6 (Culler, 1981). The sacredness of a souvenir is intrinsically related to the story the individual
7 associates with the object (Budruk, White, Wodrich & van Ripper, 2008); this does not necessarily
8 manifest itself to everyone (Decrop & Masset, 2014; Masset & Decrop, 2020), but is confirmed
9 through a process of 'hot' authentication: "an imminent, reiterative, informal performative process of
10 creating, preserving, and reinforcing an object's authenticity which lacks a well-recognized
11 authenticating agent". The process of 'hot' authentication is "emotionally loaded, based on belief,
12 rather than proof, and is therefore, largely immune to external criticism" (Cohen & Cohen, 2012,
13 p.1300). Cheaply made, mass-manufactured souvenirs may not be valuable or have intrinsic worth,
14 but they are meaningful to the person that consumes them both as a piece of evidence and as a
15 piece of personal archive (LaSusa, 2007). In constructive or symbolic authenticity, things appear
16 authentic not because they are inherently authentic but because they are constructed as such in
17 terms of points of view, beliefs, perspectives, or powers (Rickly-Boyd, 2012; Wang, 1999). As such,
18 "objectively authentic and constructively authentic souvenirs co-exist in the marketplace" (Swanson,
19 2013, p. 74).

20 Postmodernists further posited that in the post-industrial era the schizophrenic modes of space and
21 time resulted in large scale, mass production and uniformity rather than setting the conditions for
22 self-fulfilment (Goulding, 1999, p. 837); there was no longer a boundary between real and fake
23 objects (Baudrillard, 1998) and real and fake experiences (Urry, 1995). Wang (1999) argued that
24 the postmodernist deconstruction of authenticity paved the way for existential authenticity, which
25 refers to the state of Being, Heidegger's *Dasein* or the fusion between the self and the external
26 world (Vettese, 2017). "A search for existentially authentic experiences results in preoccupation with
27 feelings, emotion, sensations, relationships, and self" (Rickly-Boyd, 2012, p. 273), and faith that
28 authenticity can only be achieved, in the liminal moments of tourism experiences (Knudsen, Rickly &
29 Vidon, 2016). Instead of dismissing postmodern authenticity altogether, Knudsen et al., (2016) and
30 Vidon (2017) counter-argued that, it should be expanded to include psychoanalytical authenticity, an
31 experiential phenomenon of tourism that allows for authenticity's split nature of conscious and
32 unconscious elements and the expressible and the inexpressible.

33 Baudrillard considered souvenirs as simulations, as examples of kitsch, pseudo-objects that define
34 our consumer society but imitate, ape, real objects (Baudrillard, 1998). Souvenir objects reaffirmed
35 the value of the rare, precious, or unique object on which they were based. Following the premises
36 of psychoanalytical authenticity, kitsch souvenirs are seductive even though they are staged
37 because they satisfy the visitor desire to engage with the fantastical. Individuals thus, search for
38 authenticity in tourism experiences even when consuming environments and objects that are
39 evidently staged, fake or reproductions of originals because they seek objects and experiences to
40 fill the "lack" alienation creates in their daily lives (Knudsen et al., 2016).
41
42 Although Rickly-Boyd (2012) considered the materiality of souvenirs and their function as part of the
43 tourism ritual, understanding how alienation is driving souvenir consumption and the search of
44 authenticity is missing in the tourism souvenir literature. Lovell and Bull (2017) distinguished
45 between 'real-real' experiences, that are hot, existential, personal, and contemplative. 'Fake-real'
46 states, that are cool, cognitive, exploring 'mechanistic authenticity', the facts beneath the surface of
47 objects. 'Real-fake' impersonations concerned with re-enactment, irony, performance, and staging.
48 'Fake-fake' awareness of commodification can lead to feelings of alienation and hypervigilance.
49 'Hyperreality', 'magical reality' and 'unreality' involve the sensation that reality is magnified, copies
50 are real, and reality copied and 'virtually real'. Perceptions of souvenir authenticity are influenced by
51 the nature of the consumed tourism experience and may fluctuate as tourists switch between the
52 different states, rather than remain static, as the tourism literature suggests. Additionally,
53 technological innovation generates potential for increasingly immersive, hyperreal, and fantastical

3

forms of expression (Lovell and Bull, 2017), where the boundaries between 'authentic' and 'fake', 'real' and 'virtual' are blurred. "The digital world opens a host of new means for self-extension, using many new consumption objects to reach a vastly broader audience" (Belk, 2013, p. 477). Digital souvenirs, whose qualities differ from those of physical objects are worthy of further consideration and discussion.

Digital and scanned objects as souvenirs

Dematerialisation, or the shift from physical, tangible objects to intangible, digital consumption objects, and further miniaturisation, the way that more content can be stored in less space, facilitating further distribution (Johannßen, 2018), are defining features of the virtual world where nothing is quite what it seems. Belk (2013) considers the digital object as the archetypal example of object aura-loss through reproduction, whose lack of physical form, non-rival use, and replicability potential challenges the notion of object biographies (Mardon & Belk, 2018), but researchers in tourism and archaeology studies disagree.

Digital photographs are the most common type of tourist souvenir. Unlike photographs that were mechanically reproduced and thus lacking in Benjaminian aura, digital photographs are reflexively produced and reproduced and are therefore, auratic (Rickly-Boyd, 2012; Haldrup & Larsen, 2003). Similarly, studies in Archaeology (Gartski, 2017; Jones, Jeffrey, Maxwell, Hale & Jones, 2018) and museum studies (Kenderdine & Yip, 2019) concluded that the creation of digital models mediates the authenticity and status of their original counterparts through the networks of relations in which they are embedded (Jones et al., 2018). Moreover, the original's aura can also migrate to digital copies through both attention to the aesthetics of digital visualisations and active community participation in their production (Jeffrey, 2015). This suggests that digital souvenirs may have Benjaminian authenticity and aura if the right conditions are met during their (re)production process.

Since "questions surrounding the authority and aura of objects resurface at the arrival of new forms of media that facilitate novel paradigms of object mediation" (Kenderdine & Yip, 2019, p. 4), it is worth exploring the qualities of objects created through additive manufacturing, a production method that "entails a completed or part of a product being 'printed' layer by layer through the use of composites that are 'sprayed' within the confines of a printer" (Gress & Kalafsky, 2015, p. 43). 3D-printed objects are neither mass-manufactured, nor handmade. Rather, they are customizable like handmade objects but made through less intimate and perhaps production-like methods as in mass-manufacturing (Nam, Berman, Garcia & Chu, 2019).

3D printing is often associated with the Maker Movement, an umbrella term for independent makers (designers, inventors, traditional artisans and 'tinkerers') who work as individuals or groups, often in open access facilities and sharing ideas utilising online group forums (Vettese, 2017). It crafts artisanal items, in a variety of materials, but through a mechanical reproduction process that engages the maker in ways that differ from 'pure' hand craft or that which has been uniformly 'manufactured' by machine (Rotman, 2013). It is possible then to empathetically experience some of the 'hand' movements of craft while benefitting from the machines' precision and ability to replicate in quantities (Cheng & Hegre, 2009). The glitches and marks on 3D printed objects which make them unique and original act like tool marks. A 3D printed artefact thus, acts as a physical object; it has an ontic difference from its digital source (Perkins- Buzo, 2017, p. 166).

The innovation potential of 3D printing is substantial but its significance for tourism consumption remains under-explored. Birchnell and Urry (2016) posited that 3D printing potentially undermines the authenticity of cultural artefacts. The proliferation of replicas of original, priceless masterpieces with the ubiquity of 3D scanning and printing evinces and unsettles a widely held 'trust' in the value of objects. Anastasiadou and Vettese (2018) identified retail-related, artefact integrity and intellectual property issues stemming from the adoption of 3D printing within heritage retail environments.

While studying how digital 3D models of museum artefacts from the Usher Gallery and the Collection in Lincoln, UK, became available online for free for users to 3D print their own copies of the artefacts, Younan (2015) concluded that 3D printing could potentially detach the souvenir completely from a specific place, object, or experience. She further posited "the printed objects were simply the users' engagement with the files" (Younan, 2015):

> These 3D printed miniatures resemble souvenirs. […] They are accessible anywhere at any time and are no longer necessarily connected to the experience of visiting a place or seeing an original object. They are souvenirs of visits not experienced but substituted through surrogate engagement with the digital reproductions (Younan, 2015, p. 27).

However, Younan did not empirically query the users' perspective of their engagement with the files or the desirability of the printed objects as souvenirs. Similarly, Héctor Serrano's project, who produced Reduced Carbon Footprint Souvenirs for an exhibition of sustainable design at the 100% Design London in September 2007 (Fairs, 2008) also did not empirically study visitor perceptions of the items. The transition of the 3D printed objects through different states, analogue (original item) to digital (scanned file), to analogue (printed item) poses numerous questions about their very nature. Is the 3D printed item a replica or copy of the original only? How does the transition through the different states impacts on object aura and authenticity? Finally, does the (re)production process affect how visitors perceive and authenticate such objects against the souvenirs they usually purchase?

Anastasiadou and Vettese (2018a, 2018b; 2019) studied visitor and manager impressions of 3D printed souvenirs in a heritage site. Unlike Younan's claims of detachment, their study demonstrated that there is potential for novel visitor engagement through the making of 3D printed souvenirs which can alter visitor connections to the site and authentication processes. This paper expands on their work and argues that by facilitating visitor engagement in souvenir making, the technology enables the formation of new interconnections between visitors, souvenirs and tourist spaces which imbue the 3D printed souvenir with its own aura and authenticity.

METHODS

A team of design and tourism researchers developed the initial project that examined the possibility of adopting additive manufacturing as a souvenir production method in heritage environments. Working in collaboration with Historic Environments Scotland and funded through the UK's Arts and Humanities Research Council, the empirical data collection took place in Stirling Castle in Scotland, in July and August 2014. The researchers wished to capture the visitor impressions of 3D printed souvenirs created onsite and how visitors evaluated these objects against the generic souvenir fare available at the Castle. A data collection protocol was agreed with Historic Environment Scotland and participants also signed a research consent form that detailed the use and storage of the information they provided.

The research design followed an exploratory, inductive approach underpinned by social constructivism. According to Guba and Lincoln (2005), constructivism posits that reality can only be known through multiple mental constructions that are based on experience and socialization but are also local and specific in nature. Constructivists embrace subjectivity as inevitable, and their findings are explicitly informed by attention to praxis and reflexivity (Patton, 2008).They adopt a relativist ontology, subjectivist epistemology and hermeneutical/dialectical methodology (Lincoln, Lynham & Guba, 2011), and propose that naturalistic inquiry should be judged by dependability (a systematic process followed systematically) and authenticity (reflexive consciousness about one's own perspective and appreciation for the perspectives of others) (Patton, 2008). We approached the study from a constructivist perspective, in that we acknowledged 'what people like' as important and natural in understanding how they consume souvenirs.

1   Initially, the team intended to set up a stall with a 3D printer inside one of the Castle's gift shops.
2   During the pilot survey, which was carried out to determine the ideal location of the 3D printer, and
3   to review the interview guide and the logistics of collecting data on location, the gift shop was
4   determined to be unsuitable due to space limitations. Instead, the printer was set up in one of the
5   Castle's main galleries for the four days of data collection. This was a serendipitous development,
6   as it enabled the visitors to experience the creation of souvenirs onsite and during the visit, and
7   researchers to observe visitor engagement with the 3D printer within the attraction space. An
8   Ultimaker 2 prototyping portable 3D printer produced souvenirs in a variety of materials to show to
9   visitors, who were invited to take part in a short, structured interview. Participants were able to see
10   and hear the items being printed and received a 3D printed unicorn (to reflect the Castle's branding)
11   as a thank you for their participation. Video recording and participant photography was prohibited in
12   the agreed protocol with HES – (see Figures 1-3 produced during data collection).
13
14   Fig. 1
15
16   Fig. 2
17
18   Fig. 3
19
20   Structured interviews were selected to ensure consistency in the data collection process among the
21   three researchers and to keep the interviews to approximately 8-10 minutes in duration, to
22   encourage visitor participation. They consisted of six questions which sought to identify the
23   interviewees' knowledge and exposure to 3D printers; their impressions of the printed souvenirs;
24   their willingness to pay and interest in souvenir personalisation. The researchers explained the
25   purpose of the study and handwrote the answers. The audio recordings were only used for
26   verification.
27
28   In total, 139 interviews were carried out consisting of 64 male and 75 female participants. The
29   interviewees were British (31%), 19% originated from the USA; other visitors came from Spain,
30   Canada, France, and Australia. Many of the interviewees were in the 31-45 age segment (37.4%)
31   followed by the 46-60 age group (26.6%), which reflects the standard visitor profile in UK heritage
32   attractions.
33
34   The majority (90%) had heard of 3D printing before. One of the researchers input the data in Excel
35   for the other two researchers to analyse, which provided investigator triangulation of the data
36   (Decrop, 2004). Excel was selected because of the short-answer nature of the questions, and to
37   handle the participant demographic data. During the initial thematic coding, additional themes
38   emerged namely how people select their souvenirs, the significance of materiality, the authentic
39   qualities of souvenirs and the sources of value. The data that was re-coded inductively forms the
40   basis of this paper.
41
42   Researchers also carried out non-systematic participant observation, which is particularly
43   appropriate for exploratory studies aimed at generating theoretical interpretations (Jorgensen,
44   2011). Participant observation connects the researcher to the most basic of human experiences,
45   discovering human behaviour through immersion in a particular setting (Guest, Namey & Mitchell,
46   2017). Observation during the data collection process allowed the researchers to capture and reflect
47   on visitor behaviour within its physical context and consider the significance of their own presence
48   and interactions with the visitors and staff on site and the 3D printer. These fieldnotes are presented
49   alongside the interview data, to supplement the findings and provide more context of the study
50   setting and participant responses.
51
52   Tracy (2010) argued there were eight key markers of quality in qualitative research including (a)
53   worthy topic, (b) rich rigor, (c) sincerity, (d) credibility, (e) resonance, (f) significant contribution, (g)
54   ethics, and (h) meaningful coherence. The study was led by these criteria and focused on an
55   emerging production method that is reconfiguring object-person relationships and notions of object

6

authenticity. It described, in detail, the study context and how serendipity influenced our data collection process we are being transparent and sincere.

In combining theoretical perspectives from tourism and design literature the team sought an interdisciplinary triangulation (Decrop, 2004), and evidenced multivocality in the inclusion of the researchers' observations as member reflections of the data collection and analysis processes. As our study is based in one heritage site only, the team were cautious that generalisations may not apply in different settings. Finally, we met our ethical obligations by adhering to our institution's research integrity code of practice and the commitments contained in our Historic Environments Scotland protocol.

FINDINGS

The researchers wished to explore if the creation of 3D printed souvenirs on site altered the visitor experience of the historical attraction. One of the unexpected findings was the significance of the location of the 3D printer within the historical building as opposed to one of its retail spaces. Researcher 1 described the data collection setting:

> During the four days spent at Stirling Castle we were situated just inside the entrance to the main hall under the minstrels' gallery. The set up was a banquet table that had the 3D printer, polymers, and 3D printed examples on it. For the first three days, [Researcher 2] and myself spoke to the public and demonstrated the printer and on the last day [Researcher 3] joined us. The area was quite dark where we were situated but because the printer lights up and makes a singing noise, this seemed to attract people to the table and us.

The contrast between the dark setting and the lights and sounds of the printer attracted (distracted?) visitors to the part of the room where the researchers were positioned. They would have not anticipated to experience a machine working away creating sound and light within a space that is normally dark and quiet. The novelty of the 3D printing experience was an additional attraction as at the time, some of the visitors had heard of 3D printers but had not experienced them in real life. "For some people, when they realised that they didn't need to buy anything they were far more engaged. Others had never seen 3D printing before 'in the flesh' and so were very intrigued to have a look" [Researcher 1]. Experiencing the printer, live and onsite, also impacted on the visitor impressions of the 3D printed souvenirs who then reflected on their suitability as representations of the Castle, their material qualities, and their own impressions of the objects.

Connection to the Site

Souvenirs create an emotional association to the place visited (Swanson & Timothy, 2012) because they have been physically acquired at that given location or in that given moment (LaSusa, 2007). In addition, shopping in heritage buildings seems to increase the value of the items purchased (Lovell, & Bull, 2017), as if the goods have taken on the value of the place in 'adjacent attraction' (Crawford, 1992, p. 14; Bryman, 2004). Some interviewees suggested that souvenir personalisation through 3D printing created stronger associations with the visited site. "I can have anything I want? My moments of Stirling castle today? Because when anyone comes here, it's what it means to them" [Female, 61-75, UK]. Others also intimated that the opportunity to print objects and artefacts experienced during the visit, was an additional, attractive quality of 3D printed souvenirs. "A good idea, I like the idea of scanning items and making what you like" [Male, 46-60, UK].

While discussing hand crafted souvenirs, Halewood and Hannam (2001) argued that *seeing* the object being made gives the souvenir object further authenticity. The in-situ production of the 3D printed souvenir made it more authentic than those items manufactured elsewhere. Researcher 2 observed: "Some people engaged with the idea that the product had been made there and that they liked that this seemed more authentic to them than items which had been 'made in China'".

7

1 Unlike standard mass-produced souvenirs which depend on international distribution chains
2 (Timothy & Boyd, 2003), the in-situ production of the souvenir provided visual verification of its
3 provenance, the production process, and the selected materials. It was a form of micro-
4 authentication (Lovell & Bull, 2017) that connected the object's biography to the visit and location.
5 "They didn't necessarily want or need to see their very own piece printed but they felt that there was
6 more authenticity if the object had been made for them in situ at the attraction" [Researcher, 2].
7
8 Previous knowledge of 3D printing was varied among the interviewees so *experiencing* 3D printing
9 was also a highlight for some participants, which further added to their engagement with the
10 souvenirs. Researcher 1 also observed: "People seemed to 'get it' more when they could see the
11 process, and this gave them a sense of involvement, ownership, and participation".
12
13 Novelty, discovery, and participation are not vocabulary one usually employs to discuss how
14 souvenirs are created, purchased, or consumed. Researcher 2 further observed:
15   Certainly, across the generations the experiential nature of the printer in action was a
16   significant part of their reaction to the products. Many of the older generation [46 and over]
17   referred to this as the 'future' and were interested to see the printer in action.
18 Experiencing souvenir production onsite incorporated elements of performance and play not usually
19 associated with the consumption of souvenirs. It enhanced further the visitor connection to the site
20 (Anastasiadou & Vettese, 2018b), suggesting that there is significant potential for visitors to engage
21 more meaningfully with visited places through the consumption of 3D printed souvenirs.
22

23 *Authenticity markers*

24 The interviewees reflected on whether the sample 3D printed objects were appropriate as souvenirs
25 for a historic attraction. Their materiality, authentication methods and potential for singularisation
26 were discussed in greater detail.

27 3D printed objects may be created in a variety of materials depending on the adopted production
28 process (Nam et al., 2019). An object's materiality remains a significant marker of how people
29 assign it authenticity (Jones, 2010), with certain materials considered more "natural" than others
30 (Kälviäinen, 2000). Printing souvenirs in wood and metal may be perceived as more appropriate
31 and authentic than souvenirs printed in plastic, within a historic site: "More impressed with the
32 wooden bangle than the plastic ring. [Wooden] bangles are more appropriate here than the plastic
33 stuff" [Female, UK, 31-45].
34
35 Although the mode of production was mechanical and the object was created with wood filament
36 rather than original wood, it was still perceived as being superior, a type of 'fake real' (Lovell & Bull
37 2017). Researcher 2 further observed:
38   Many people were more interested in the metal and wooden polymer and a couple of people
39   referred to these materials as being more in keeping with the atmosphere of the castle,
40   words such as authenticity were mentioned, and it was seen that the wooden polymer and
41   the more traditional materials were seen to be more 'authentic' to the castle.
42 3D printed souvenirs can thus be constructively authentic (Swanson, 2013), if they are reproduced
43 in the materials the visitors consider to be in keeping with the historic attraction. Visitor comments
44 also indicated a desire for the souvenir to not digress from the representation of the past and a
45 perception of authenticity that stems from being true to 'traditional' materials (Cohen & Cohen,
46 2012), despite the mechanical reproduction process.
47
48 Researcher 2 observed intergenerational differences in terms of visitor impressions:
49   There was a variant reaction to the 3D printed products, with the older generations [46 and
50   over] being less keen on the plastic nature of the products. Children were particularly
51   interested in the plastic printed items and saw them as a 'toy' like project. Adults who were
52   with children often expressed the educational benefits of the 3D printer and believed the

experiential aspect of seeing the printer active would be an important component to the project.

Previously Baker et al., (2006) considered how children select and attach meanings to their souvenirs but studies of intergenerational characteristics and souvenir consumption are lacking. Literature has focused instead on how different cultures (Fangxuan & Ryan, 2018; Kong & Chang, 2016) genders (Kim & Littrell, 2001; Wilkins 2011) or tourist types (Shen, 2011) consume or gift souvenirs (Kaell, 2012). The technology dimension on this occasion, posits questions about how it generates different reactions in different generations.

Additive manufacturing allows us to empathetically experience some of the 'hand' movements of craft (Cheng & Hegre, 2009), which can act as a source of authenticity (Kälviäinen, 2000). 3D printing, particularly an inexpensive machine such as the Ultimaker 2, incurs occasional flaws in the processes and glitches in the printouts. The unique nature of 3D printed items, which can involve looking layered and striped, was remarked. "I can feel the ridges, I guess it is how it's done… Being able to create something sounds cool" [Female, 17-30, USA]. Researcher 2 reflected: "Many people were more interested in the souvenir possibilities when they were able to feel and see the designs, there was a very tactile and visual response to the items".

Although the public could see the imperfect 3D printing processes and breakages, where the 'romance' was removed from the making process, in this case, it appeared to add to their visitor experience. The 3D printer created unique 'maker's marks' on each printed object, just like crafted souvenirs, which elevated them from standard, mass produced objects. Moreover, it appeared to 'humanise' and further authenticate a mechanically reproduced object.

Cool authentication (Cohen & Cohen, 2012) was evident when authentication certificates were proposed to confirm the provenance of the 3D printed souvenir in what resembles objective authenticity (Lau, 2010). A certificate would "prove the souvenir authenticity, that it was indeed printed at Stirling castle, during a visit" (Researcher 2). "If it's personal there's more value, and the experience adds to the value. Also, to add value could be a little certificate" [Female, 31-45, USA].

The in-vivo souvenir production and possibility to design and customise a souvenir could lead to hot authentication (Cohen & Cohen, 2012) through a variety of means and facilitate the visitor engagement in alternative souvenir consumption. "Pretty cool, if you can see it happening and choose, it's fascinating" [Female, 31-45, UK]. "Like the coin making its good, everyone can choose their own souvenir. The process is important like a Polaroid" [Male, 31-45, Netherlands]. Researcher 2 reflected that "a Polaroid picture means more because of how it is taken"; so too did the 3D printed item because it was possible to experience it materialising in real time. In this way, the visitor no longer remained alienated from the souvenir production process.

Although the visitors did not have the opportunity to design and print their own souvenir during their visit, the technology offers design potential. Experiencing the souvenir object taking shape made the 3D printed item a more valued possession because there had been some investment of personal time in its production process (Anastasiadou & Vettese, 2019), and multiple opportunities for authentication. Linking the 3D customised object to the sense of self (Baker et al., 2006), the interviewees claimed it was always nice to get something personalised and choose exactly what you liked. Personalised items made them feel special because they are unique. "[The 3D printed souvenir has] more value at the moment, it would have to have more, you would expect it too. With the date, it is novel, so I like that initial thought" [Female, 31-45, UK].

Souvenir personalisation through inscription functions as hot authentication. At its most basic level, inscribing objects with names or initials signals ownership, marking an object as the possession of a specific individual and their identity (White & Beudry, 2009, p. 218). 3D printing offers greater possibilities for singularisation beyond inscription, which constitutes its biggest appeal. Researcher 2 reflected:

9

When asked about the options to personalise people became a lot more engaged with the project, these discussions were difficult not to be leading, as some people's imaginations were more engaged than others. However, whether the researcher offered ideas, or the respondents did, the reaction to personalisation was overwhelmingly positive. People felt that value was intrinsically linked to the personalisation process and that the items would have more value if they had some form of personalisation. The options of the 3D printer and what it could allow them suddenly became a more exciting prospect to them.

The possibility to scan an object related to the visit to produce a customised 3D printed souvenir, highlighted further their potential to cater for individuality (Decrop & Masset, 2014) and uniqueness. Personalised objects may also be used and treasured as precious keepsakes rather than expendable throwaways, as researcher 2 observed:

People could see the options for individualisation, and these ranged depending on the interests of the tourists. Some people liked the idea of being able to have their name or a message integrated into the design. The date of their visit was a popular idea, with the authenticity and the link between them and the castle becoming stronger with this personalised memento. Others recognised that the options for products could be much vaster than now available. One lady mentioned her sister was obsessed with old doors and thought that the idea that she could have a copy of a Stirling door printed in miniature as a piece of jewellery would be something that would be perfect for the sister. The idea that an individual's taste and personal connection to the castle could be more keenly met was very popular with respondents, and even those who expressed a displeasure for souvenirs, could see the benefit in this.

The visitors' interest in further souvenir individualisation appeared to enhance their connection to the site and their souvenir. By participating in design decisions, 3D printing created further opportunities for visitor self-expression (Belk, 2013).

Souvenir aura

On reflecting on the ontic significance of 3D printed objects, some interviewees perceived them as replicas of the artefacts and others as individual objects. Researcher 2 observed: "One respondent expressed the idea that the 3D printer could make an exact replica of an historical object, and the idea that this would be so exact in its replication was beautiful to her [Female, 61-75, UK]". Researcher 1 also observed: "This person was really interested in the idea that a historical replication could be done but made exactly as it was before".

This reflection echoes Galeazzi (2018) and Jones et al., (2018) discussions about the significance of the accuracy of the digital scans to determine the extent of authentic representation of an original. This participant focused on the capacity of 3D printing technology to produce a faithful copy (Baudrillard, 1998) and the exact replication was a strength rather than a weakness of the object. If this mechanistic authentication is superheated by belief in the object's value, it is possible to have an authentic experience of an artificial object (Lovell & Bull, 2017). "[…] Others recognised that the individuality of the products through this exact replication maybe would detract from the value of the piece [Researcher 2]". Like Benjamin's (1968) assertions that copies lack the biography of the item they represent, these individuals echo Birchnell and Urry's (2016) concern that the 3D printing's infinite capacity for reproduction would compromise the artistic significance of cultural artefacts.

At the opposite end, other participants perceived the 3D printed souvenir as a new, unique object specific to them even though it could be printed for many people simultaneously, echoing a constructive authenticity (LaSusa, 2007). "Yes, I think it is unique, it is better. [Even though it is printed], you still think yours is unique, you feel special" [Male, 31-45, Netherlands].

As Bakker (2018) explained, aura is made of knowledge and belief about the object's social context and provenance and the physiological impact of the artefact. The visitor reactions would suggest that although the object biography of the 3D printed object is confirmed and the visitor is no longer

1 alienated from the in-situ souvenir production process, the object's physiological impact remains
2 relative to the individual.
3
4
5 **DISCUSSION**
6
7 The study findings indicate that 3D printing souvenir objects within visitor attractions generates
8 additional opportunities for self-expression, hot authentication, and performative authenticity.
9 However, 3D printing depends on digital file sharing and allows printing multiple times, most
10 commonly in plastic, so the objects may be considered of low quality and value. If the 3D printed
11 object is viewed simply as a replica or reproduction (fake-real) (Lovell & Bull, 2017), it does not meet
12 the requirements of objective authenticity, which is determined by the value of the object in the
13 marketplace and its singularity (Swanson, 2013). Certification, inscription, and personalisation were
14 desirable devices for individuals to textually declare and conspicuously show they have engaged
15 with the heritage environment, further enhancing the 3D printed objects' authenticity. Moreover, 3D
16 printed objects can be constructively authentic, if their users' value them as such, and can contain
17 experiential authenticity, if the users participate in the (re)production process.
18
19 The onsite interaction with the making process and the potential to personalise, allowed participants
20 to add something of their selves to the souvenir object and further differentiated the 3D printed
21 objects from traditional mass-produced and craft souvenirs. Being able to select, add to, and
22 change one's souvenir attached individualism to the object, and this added emotional investment in
23 the process further bounded the visitor to their visit. The souvenirs, therefore, have a positive effect
24 on the visitor relationship with the heritage site and their memory of their experience. Because of
25 this co-production, between individual and technology, the process of creating a 3D printed object is
26 a form of *becoming*- its material form is not simply a mental conception or an exact copy of an
27 original but comes into being during production. As Latour and Love (2011) discussed *having* the
28 reproduced object in the original location adds originality to the object through adjacent attraction
29 (Bryman, 2004) but 3D printing extends it further, as the reproduced object is not only *seen*
30 (Halewood & Hannam, 2001) but also *created* in the original location. The souvenir is unequivocally
31 tied to the experience and the location (object-place relationship), its object biography sanctioned.
32
33 3D printing souvenirs combines the traits of mass production and individually 'experienced'
34 handicraft while also allowing for an element of interaction with the 'tools' of its making. In this way,
35 visitors may perceive 3D printed objects as unique to them. Crafting one's own souvenir modifies
36 existing ideas about the significance of souvenir consumption for identity construction. 3D printed
37 objects lead to self-extension through instant, expressive media and singularisation. Combining
38 mechanised process with personal engagement and recording both hand and machine movements
39 as memory traces, the 3D printer adds layered meanings to the souvenir-making experience and
40 further connects the visitor to the object and location. Digital making can then become a catalyst for
41 creativity, leading to the 'crafting' of more compelling souvenirs whose added digital complexities,
42 (flaws, ridges, and blemished surfaces), resemble those of traditional crafts and artefacts.
43
44 We agree with Jones et al., (2018) assertion that the mode of production and participatory practice
45 are important elements in considering the authenticity of the 3D objects. The degree of visitor
46 engagement with the design and reproduction process is a key determinant factor in discerning
47 souvenir authenticity. Is the final consumer of the 3D printed object a passive receiver? Or are they
48 a designer, in which case the object is one of a kind, unique to them, and its presence in their own
49 homes gives it constructive authenticity and aura? Although the additive manufacturing user gains
50 access to artisanship, this does not suffice to produce works of art or desirable souvenirs; training in
51 the technology as well as possessing artistic quality and skill will also be necessary to produce
52 desirable souvenirs that could be offered commercially. However, for the amateur designer or
53 crafter, additive manufacturing can create new media and novel outlets for creative endeavours and
54 self-expression.

Although participants were divided in their opinions of the authenticity of 3D printed souvenirs, these objects meet many of the determinants of souvenir authenticity that had previously been associated with craft souvenirs, such as provenance, object biography, the maker's mark, as well as novel aspects such as visitor participation in the design process, emotional investment and experience of the production process, and personal expression through personalization. Additionally, while the novelty of 3D printing may have been part of its appeal, interacting with the 3D printer also enhanced the visitor experience.

To revisit Benjamin's theorisation of authenticity, we assert that the 3D printed souvenirs that are created onsite have more Benjaminian aura than craft or mass-produced objects, as they are unequivocally connected to the site and their historical testimony confirmed. Experiencing the making process and observing the 'maker's marks' makes the souvenir's authenticity more tangible. 3D printing also supports the reincorporation of craft elements in the making process lost since the era of mass reproduction (Benjamin, 1968), and the re-engagement of the individual as a maker. The potential for infinite reproducibility of 3D printed souvenirs challenges the notion of scarcity which is central in object authenticity. However, each 3D printed item is a unique object, not just a sophisticated reproduction. The 3D printed souvenirs do not only function as objects that memorialise the ritual of tourism (Rickly-Boyd, 2012); in this study they became part of the experience itself. As well as being objects of ritual, through the transience between physical states and the user involvement in design decisions, the 3D printed souvenir is also imbued, with its own aura and authenticity.

CONCLUSIONS

The aim of the paper was to consider how the creation of artefacts using the medium of additive manufacturing may impact the consumption of tourist souvenirs. Previously, theories of souvenir authenticity had focused on how close to the 'real' artefact the souvenir item is (object authenticity), or the significance of the item for the construction of identity (Belk, 2013) and associated meaning(s) (Baker et al., 2006). In discussing the nature of tourist souvenirs and authenticity, four key areas were discernible: 1) their function as simulacra of local culture (constructive); 2) the expression of individuality and identity (existential); 3) their ontic significance (objective), and 4) their material dimensions (mode of production, materials used). Our study findings can add a fifth element, participation (through co-production between the individual and technology) - or to what extent is the souvenir holder involved in the (re)production of the object?

The findings highlighted how the conceptualisation of souvenir authenticity and symbolic value becomes more complex when objects are reproduced through additive manufacturing. Despite the use of plastic and media of mass (re)production, the traditional view of the souvenir as a kitsch object was challenged in this study and instead transposed, as a multi-dimensional, amenable, yet fortuitous, individual but co-produced, modest yet valued, possession. Souvenirs were re-evaluated as non-static mediators of individuality, memory, sentiment, and experience. Seeing 3D printing in-situ still embodied 'skill' which added to perceptions of authenticity and the value of the souvenirs. Moreover, it became apparent that the 3D printed souvenir contains its own aura, and is an authentic object because of its reproduction process, which allows simultaneously for mass production and individualisation. Although Younan (2015) claimed 3D printing decontextualised the printed object from its original, in the circumstances of our study which involved in-situ and in-vivo reproduction, the 3D printed souvenir had added dimensions of authenticity because of its enhanced connections to the heritage site. Gift shops in visitor attractions could stand to benefit from the onsite production of souvenirs that are meaningful to visitors who seek to escape mass produced, environmentally unfriendly souvenirs. Future research could study further the individuals' motivations in selecting 3D printed objects as souvenirs in a range of tourism environments and

experiences and their relative advantages and disadvantages in comparison to 'traditional' souvenirs.

Our study makes a unique contribution to the theorisation of 3D printing and its impact on different aspects of social life and consumption. Additive manufacturing has the potential to disrupt society and social organisation, ushering new art forms, and new consumption modes and patterns. Drawing parallels to Benjamin's assertion (1968) that mechanical reproduction enabled the blurring of the boundaries between writer and reader, additive manufacturing challenges the distinction between designer, consumer, and maker. Future research may focus on whether it demands a cultural response, whether it has an in-built 'ideology', and how it may further affect culture within the context of tourism, education, and product design.

The paper reaffirmed the significance of materiality in understanding how people select and consume their souvenirs in the digital era. Physical objects, the materials from which they are constructed and their connection to the tourist experience or visited site remain significant. The imperfect nature of 3D printing, including the breakdowns in technology, glitches, and ridges, while 'unromantic', appear to add to the realism, interest and authenticity of the object and visitor experience. The meaning of the souvenirs is, therefore, mediated and can change over time, from individual to individual and between objects that have been printed out using the same file. Mass produced becomes highly personal and bespoke with implications for manufacturing methods, engagement, and profitability. Future research may consider how psychographic or intergenerational characteristics affect preferences for different materials and perceptions of object authenticity and souvenir preferences.

To explore how people perceive the authenticity of 3D printed objects, we reviewed the breadth of authenticity typologies rather than focusing only on one approach. The literature review indicated that acknowledging the dialectic relationship between authenticity and alienation is lacking both in terms of souvenir literature and in the study of 3D printed objects, including our own study which did not explicitly consider alienation. Does additive manufacturing offer the same emancipation potential for visitors from the ritual of being a tourist? Future studies should unpack further how technological innovation mediates authenticity and alienation in souvenir consumption.

Since carrying out the study, the use of 3D scanning and printing to engage with audiences for education and conservation purposes has expanded. More museums have 3D scanned artefacts from their collections and have made them available online (see for instance the Scottish Maritime museum, the Science Museum in London, and Rijksmuseum in Amsterdam). The authors are continuing with their research on how 3D printed souvenirs, including those made with innovative site-specific materials, may transform visitor experiences in different tourist settings.

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