Contemporary Installation Art and Phenomenon of Digital Interactivity: Aha Experiences – Recognition and Related Creating with and for Affordances

Anthony L. Brooks[(✉)]

Aalborg University, 9000 Aalborg, Denmark
tb@create.aau.dk

Abstract. Observing audience attendance of a student created interactive art installation is posited relating to phenomenon of serendipity, brought about via cumulated conditions and strategies, synchronously resulting in an author-recognized '*Aha experience*'. Identifying of engagement, then disengagement, and subsequent re-engagement informs reflections and critique. Speculation to how multi-affordances in an interactive art installation can combine with perceptual and cognitive pre-knowledge, e.g. pervasiveness of sensors in contemporary society (as audience pre-knowledge), to influence audience expectation, explorations, and engagement experiences. This contextually illustrated in how affordances (false/perceptual/hidden) of the installation became aspects that unwittingly and coincidentally cumulated to establish a *critical incident* moment: A period in time that serendipitously and synchronously involved observation of audience disengagement following initial confrontation immediately followed by a system reset that stimulated (as if playfully) re-engagement. Conclusions question how a strategy of *playful artistic design* that incorporates such audience perceptual and cognitive influencing through affordances can be a potential factor utilized in realizing interactive art installations. Posited thus is a contemporary art strategy goal to engage beyond artless mapping (e.g. one-to-one) toward more stimulating, intellectual, and enjoyable audience experience.

Keywords: Aha experience · Serendipitous synchronicity · Interactive art POPBL · Multi-affordances · Playful design

1 Introduction

1.1 Art and Technology Education, Aalborg University, Denmark

Aalborg University[1] (AAU) has, since its inauguration in 1974, originated, established, nurtured, developed and continuously evolved its Project-Organized Problem-Based Learning teaching model (PBL or POPBL) – see e.g. [1]. Under the Aalborg University PBL model, students study in groups to initially formulate a problem under

---

a dedicated semester project theme that typically carries 15 ECTS. Another 15 ECTS covers semester courses. A group is typically 6–7 students at the start of their under-graduate education and progressively reducing in size to final semester, typically 1–3. Learning goals within a themed project description guide a group's formulation of a problem that then becomes the central focus/catalyst around which research and practical activities are conducted to realize semester objectives. Staff coordination and supervision support student study and project activities. A mixed staff and student study board manage activities of each education.

Art and Technology (ArT) education[2] is a six semester interdisciplinary research-and practice-based education under AAU's Humanistic Faculty. Students are awarded Bachelor of Arts (BA) degree in Art & Technology (Danish title of the degree is "BA i Oplevelsesteknologi"). Research (and to an extent procedure) is exploratory, as stu-dents investigate what they do not know in order, through investigating a problem, to improve their knowledge, skills, and competences aligned with the AAU PBL model.

Spring semester January – June 2018: ArT Exhibition May 8–9.

The author, as semester coordinator for ArT fourth semester spring 2018, selected an outside public space, a municipality-governed park close to AAU's downtown campus in Aalborg, as installation site for the May student semester exhibition. Such places in Denmark are considered "open to all, free of charge" [2]. Justifying selection, a goal was to challenge students with innate site-specific issues e.g. weather, security, power, … whilst offering multiple opportunities for interaction and occasions for sit-uated learning related to the outcome of interactions with the social and physical environment [3]. The public park, whilst generally open grassed areas with shrub encircled divisions separated by meandering pathways, also has numerous stakeholder areas with garden plots, adjacent kindergarten/school with play areas, skater areas, petanque courts, covered gathering spots, and a stage area for live musical perfor-mances. Main stakeholder is the municipality who run the area. An exhibition student committee representative thus had the additional challenge of cooperation with municipality contact and associated service personnel.

By locating the exhibition site away from the university the formal and controlled learning environment is distanced thus challenging students toward emergent and student-led activities targeting learning in a real-world situation outside classroom. Also, and importantly, exposure to public audiences rather than (typically) in-house peers who attend exhibitions within the campus buildings was considered positively impactful. This strategy aligns with promoting contextualized learning experiences through exploration (e.g. by experiencing things at hand in real and authentic settings), interaction (e.g. with more experienced peers and experts in the field), and serendipity (e.g. when "human search for knowledge may occur by chance, or as by-product of the main task" in unplanned, random and unexpected ways) [4, 5].

The author's role, besides coordination, included lecturing courses in interaction design, multimodal perception and cognition, and supervision of two exhibiting ArT student groups. The supervisor role changes to examiner for the students'

---

[2] https://www.en.aau.dk/education/bachelor/art-technology.

examinations. Following this opening framing behind the work, the next section narrows contextualization by introducing an ArT specific student group installation that led to the catalyst of this paper i.e. observed "Aha experience" [6, 7]. NB: Whilst students declined to co-author they agreed citation of their work SCAPE as acknowledged.

2 Places and Spaces of Interaction: SCAPE

Project theme for the fourth semester students in Art and Technology (ArT4) spring 2018 was *Places and Spaces of Interaction* under which student groups were tasked to build temporary public interactive installations in an outside park environment – a city space not associated to any museum or art-based institution or organization. Installations were exhibited over two days (8th and 9th May) and prior consultation with the local municipality as stakeholder-owner was undertaken regarding constraints, rules, use of electricity, etc. A student committee ensured all constrains were adhered.

During the exhibition days each of the student groups collected exhibition data associated to their specific installation, typically, audience reactions using various triangulation of methods and techniques. Such data are subsequently analyzed with final reports written then uploaded for grading alongside a presentation, video reportage, and oral discussion with appointed external censor and examiner.

This paper focuses on one ArT4 student installation, titled SCAPE, realized as a visually static interactive sound installation. Figure 1 illustrates the front of the work that the students changed between exhibition days due to problems as detailed next.

Fig. 1. SCAPE installation with front interface changes – Day 1 (left) Day 2 (right): © + Acknowledgements. SCAPE students: Daniela Bretes Maciel Elneff; Cristina Palo-mares; Christine Hvidt Grønborg; Jonathan Jung Johansen; Lasse Goul Jensen; Sidsel Abrahamsen.

2.1 Installation Detail and Problems

Approximate size of the SCAPE installation was 2.4 m wide × 1.8 m deep × 2 m high. Cover materials were reflective Mylar and black painted plastic on a front wall

(see Fig. 1). The design considered various modalities of audience *attractors* including semiotic affordances in the visual design (e.g. vectors, contrast, salience…). Planned main *sustainer* of audience engagement was an interactive sensor-based soundscape perceived via an inbuilt sound system. The soundscapes was designed having two defined zones of interaction – front wall (concrete embedded conductance sensors – via touch) and the perimeter three surrounding walls (Doppler sensors – via proximity). A software algorithm (patch) was created in Cycling74 MAX/MSP, a visual programming language for music and multimedia development. The MAX/MSP patch was planned to receive data from the sensors of sourced human behavior to generate the soundscape. A text document ('info stand') detailed the interactive installation and its elements for audience pre-knowledge, thus in advance of active confrontation. Design influences were cited as [8, 9].

Overview with notes of change interface and interaction:

Day 1: SCAPE front wall interface was thirty-five capacitive sensors mounted within concrete 'blobs' – see Fig. 1 left. Human touch on the concrete blobs incremented audio frequencies. A system algorithm *reset* activated once an auditory threshold had been reached to maintain sounds within a suitable bandwidth for audience listening comfort.

Day 2: The concrete encased capacitive sensors ('blobs') were removed, because of the feedback being considered by the group as 'too ambiguous and unclear'. Students stated "In terms of interaction it should be clear to the participants that they alter the sounds by their interactions and they should receive an immediate real time response." The capacitive sensors were replaced by six 10K potentiometers mounted upon a Mylar shape – see Fig. 1 right. Human audience members thus manually turned each potentiometer to influence the soundscape - so a direct influence on the sound was evident. The *reset* from day one was deactivated as potentiometer control delimited audio frequencies within the comfortable listening range.

Consistent on Both Days: Info-board text document plus five Doppler proximity sensors positioned on side and rear walls of the structure. These sensors were deactivated due to unstable signals but were left uncovered (so visible for audience).

The student group implemented a mixed-method analysis of visitors' behaviors and interactions according to a pre-defined coding scheme established in line with behavioral expressions and gestural meaning [10]. Two group members, in shifts, conducted audience observations. Post exhibition, collected data from observation sheets, recorded videos, and notes were triangulated to determine behavior patterns and standout moments relative to a formulated project problem/question. Results indicated increased engagement on day one (when observations reported audience explorations as curiosity conjoined with confusion) vs. day two when it was perceived as an alternative musical instrument but with observations reflecting less audience interest.

2.2 Audience

People know what they do; they frequently know why they do what they do; but what they don't know is what what they do does… Foucault [11]

The installation attracted satisfactory public attendance across ages and gender as one may predict for a site-specific work in an open public space on two sunny spring days. In the following section, first-hand experience from observing SCAPE audience behavior is shared from one of the author's visits. This analyzed observation led to the posited goal shared via this contribution, which relates to how Foucault's quote [11] can be reflected aligned with artists (and designers) creative use of and thinking about affordances to a higher level in order to stimulate and potentially optimize audience engagement and *Aha experiences* with contemporary interactive installations.

3 Recognition of *Aha Experience* and Reflections on SCAPE

As supervisor, the author visited the installation a number of times during the building day prior to the exhibition as well as at the opening exhibition day. Each discussion and revisit made apparent the students' despair at the installation not working as envisaged. On my final visit, late in the evening of exhibition day one, the student observer informed of the changes planned for day two. Whilst listening I observed audience attendance in the form of a small group of spectators/participants who explored all around SCAPE. They were testing perceived interfaces relative to feedback – likely as associated to the pre-knowledge given as text on the info-board. Following explorations, they disengaged by meeting approximately one meter in front of the main interface (Fig. 1 left) where they discussed their experience. During their discussion the system reset triggered, which changed the auditory feedback. Immediately the group, as one, turned and physically re-engaged with the installation to explore further questioning what had happened. The reset detail is understood as not being noted on the info-board text document. Even though they could not determine what activity they may have influenced, they continued to explore further, clearly with interest but also confusion, eventually leaving, seemingly with stimulating positive experiences but also potentially frustrating. It was not reported if same audience returned for day two.

The author's reaction was to comment to the student that it was interesting to observe such a re-engagement moment – or *Aha experience* - and it could be pertinent to question further. This the students did, to an extent, via a correlation analysis between day one and day two. However the change of installation interface prevented in-depth analysis of the system reset moment, which is herein considered a critical incident toward 'making inferences as to requirements' [12]. Thus, the *Aha experience* – one could say of both audience and observer(s) – is an aspect that could be further questioned and studied in such installations alongside designing with different affordances (false-, perceived-, hidden- etc.,) to impact human traits of audiences. Such work using sensors can thus question contemporary pervasiveness of sensors from a cultural/societal knowledge/experiences perspective to intellectually design for audience experiences via a concept of purposeful playful design with multi-affordances.

4   Discussion and Conclusions

Contemporary pervasiveness of sensor technologies (and especially their wide-spread uses in art installations to attribute interactivity as well as their integration into education and industries) means that audiences are more knowledgeable and aware than ever of how such hardware works e.g. detecting proximity, gestures, actions, etc. In SCAPE, this audience pre-knowledge can be assumed, as well as how resulting sourced data can be mapped to control selected digital output(s), in this case perceived as auditory feedback changeable to touch (capacitive sensors) or physical rotation (potentiometers). By first informing via a text that detailed interactions innate of SCAPE and then openly revealing the Doppler sensors as an apparent 'control mechanism' - but then deactivating (but still revealed) - the group initiated a dialogue with their sensor-aware audience, sending an explicit message. The concealed concrete embedded capacitive sensors offered a different message but one that equally provoked confused exploration – though an understanding is that to some degree these worked but the group declared change required. However, on day one, an understanding was thus shared, motivating engaged audience to question the interaction. The audience was encouraged to choose its own non-reliant interpretation. The open-endedness offered audience authorship and to be generators of their own meaning. The 'critical incident' of *reset* matched to *Aha experience*, according to the author's observation, provoked disruption of interpreted meaning resulting in a serendipitously syncopated happening and positive response activity of re-engagement. Exploration of the system reset moment could have focused and foreshortened video analysis in that a temporal known independent variable could have been targeted with dependent variables according to the cumulated conditions. This should have enabled a more-in-depth analysis leading to a consideration of refinement of research question based upon finding(s) rather than inconclusive outcome as reported. Aligned was the potential for a more in-depth discussion, reflections and critique in the oral examination.

A Prepared Mind: Background Enabling *Aha Experience* Recognition
Observation methods, as utilized in the ArT education, should be open, receptive, and inductive to allow relatively unanticipated aspects and links to emerge in line with Naturalistic Inquiry through utilizing defined coding schema and constant comparison of diverse audience (individual/groups) experiences and interactions [13, 14]. Thus, patterns and outliers can illustrate synchronicity and serendipitous entities within observed behaviors that inform.

Jung, we are informed, defined synchronicity on three occasions as "acausal connecting (togetherness) principle", "meaningful coincidence", and "acausal parallelism" [15, p. 23]. In other words, he defined a conscious reflective linkage between external real-world events (as observed in SCAPE) and momentary subjective state – i.e. the observer's (and possibly the audience's) *prepared mind* [16]. Further, Seifert et al. in [16]), suggested that creativity originates in a *preparation of mind* that allows subsequent recognition of the serendipitous when it is encountered. Relatively, in the literature, serendipity is widely considered an important source of artistic stimulation [17] forming "an integral part of the creative process in the arts and humanities, social sciences and the sciences. In each, however, the experience of serendipity may be

different." [18]. Further, serendipity, through being widely recognized in the literature – across disciplines – for its contribution to the generation of new knowledge, can also be impactful via (a) "reinforcing or strengthening the researcher's existing problem conception or solution", or (b) "taking the researcher in a new direction, in which the problem conception or solution is re-configured in some way" [18].

An aspect of the author's background is as an interactive artist exploring sensor-based interactions with an array of digital media. Selected credits include at Olympics and Paralympics culture festivals (Atlanta 1996 and Sydney 2000); European Capitals of Culture (Copenhagen 1996, Thessaloniki 1997, Avignon 2000); Museums of Modern Art (MoMA, numerous venues across years - including in Denmark @Louisiana; @Arken; @Trapholt...); Danish NeWave (Arhus, Copenhagen, and New York city 1999); … etc. The author's first major showing was at the Institute of Contemporary Art (ICA, https://www.ica.art) in 1978. The majority of the bespoke sensor-based art works were predominantly throughout the last decade of the millennium into the first decade of the twenty-first century. At this time sensor technologies were not as pervasive as now and the designs, whilst intellectual and playful in targeting audience experiences, also targeted inclusive audiences as creative others. Each work built on its antecedent to, in different ways, evoke "Aha experiences".

Aligned with this is the author's parallel (to the above) background history of three decades of applied research into how digital technologies, especially sensor-based, can empower interactive creative expression and playful engagement for children and adults with impairments so as to supplement traditional strategies for rehabilitation. In this work bespoke sensors adapted to best match and source human input that, as signal data, is mapped to digital content to stimulate a motivated optimal experience. Design and intervention of the author-created individual/group/room-size interactive environment (as Inhabited Information Space) are iterative such that behavioral reactions inform re-design and re-intervention until "Aha experience" is identified. Identification involves representation of user self-agency, aesthetic resonance, and efficacy. Further optimization tailors the interactive environment potentializing micro-development for those inhabiting the interactive space (e.g. patients).

To summarize a preparation of mind, in both the author's cross-informing bodies of work, as briefly introduced above, i.e. (1) interactive art installations/performance art, and (2) digital technology in rehabilitation training as technologies of inclusive well being. Elements of inductive coding, constant comparison, serendipity and synchronicity are innate alongside perceptual and cognitive multi-affordance considerations informing affective art design wherefrom research models have developed. From both aspects it can be posited from the author's first-hand artist/designer position that contemporary Aha experiences differ from Aha experiences of audiences from two decades ago as they in turn differed from Aha experiences from two decades previous i.e. around 1978 when the author showcased at the ICA. Learning to recognize differences and changes in order to create for the shifting tide has required applied insightfulness that includes, researching of human attributes, both perceptual, cognitive, affective, and beyond; researching societal and technical advancements; and more. This is believed an ongoing challenge of interactive installation artists.

This paper, through sharing a specific moment in time (the observed installation audience Aha experience) aligns to the targeted learning through exploration,

interaction, and serendipity. It speculates on the potential of artistic designs that incorporate variations of affordances to stimulate dynamic balancing to impact human experience. In other words, through considering on the one hand audience investigation, and on the other hand audience perplexity, resulting in targeted engagement, it attempts to inform of potentials that could offer additional insight to interactive art design. Such insight is posited aligned with [19] who reflect how "Interaction is not simply an opportunity to ensure the audience's participation, but instead suggests a creative engagement with the content of the artwork" (p. 46). Aligned with this is how the SCAPE students reported an inconclusive outcome to their research/problem question – however, potentially innate post-exhibition, was an opportunity to refine their question to reflect such an Aha experience that they had unwittingly achieved.

Finally, serendipity relates to chance and coincidence, as synchronicity relates to meaningful coincidence. In the case of SCAPE, the audience was alone in the space and at the right place at the right time of system reset following disengagement when the author was observing with necessary pre-experience engaged with a prepared mind to identify insightfully. Reflection on the observation is that audience pre-knowledge perceived affordances arose from contemporary cultural/societal awareness of pervasive sensor technologies (e.g. smart phones, smart devices, etc.,) aligned with the info-board text detailing designed-for interactions: interactions that were not fully functional. These combined with false affordances of the dysfunctional (clearly visible) Doppler sensors that provided the audience a conceived possibility of discoverability of actions – as expectation - with the SCAPE installation [20–22]. Reflecting the observation, it is posited that the installation's cumulated affordances evoked audience's (societal-cultural) expectations of discoverability of actions.

In closing, and provoking, the author reflects on Maeda's quotation[3] - "Design is a solution to a problem. Art is a question to a problem". Reflecting contextually asking, under the POPBL framework model from within the model's mother lode originating public higher education body and specifically aligned to the context of a selected student project under POPBL, whether, by positing multi-affordances as playful design elements in creating contemporary art installations targeting human traits, a non-answerable question and/or solution is likely given scope of human idiosyncratic. However, not one for shying away from non-answerable questions and, given the framed context as POPBL and higher education of art linked to design, it finally can be concluded that the purpose of this contribution is to argue a case in order to open the subject for conducting research around the problem asking how artists may be able to create (at a higher level?) based upon learnt recognition of affective experiences (e.g. Aha) that are transformed into affordances innate to an interactive installation. Thus, example initial research questions are posited of this unused perspective from a constructivist approach asking - "What data is optimal to be researched and under what design?" "Which methods and theories are ideal to use in this research?" "Who will be researched and under what conditions and strategies?" "How can meaning and knowledge construction in audience affect artistic creativity?" "How feasible is it to create a taxonomy of affordances that can inform design in art under a playful – targeting

---

[3] https://www.interaction-design.org/quote/show/john-maeda-1 (Daily design quote: Jul 13th, 2018).

audience – concept?" – and, finally to ask, "How can interactive art installations be optimized from a contemporary multi-affordance perspective such that synchronous serendipity plays its part as a design variable to optimize audience experiences – and thus entertainment". Here, as an outro, the reader may wish to add their own questions… and/or instead, take a moment to reflect on Kluszczynski's words from almost a decade ago where he states "Long gone are the times of fascination just with the phenomenon of digital interactivity itself" [8].

References

1. Kolmos, A., Fink, F.K., Krogh, L. (eds.): The Aalborg PBL Model – Progress, Diversity and Challenges. Aalborg University Press, Aalborg (2004)
2. Eriksson, E., Hansen, T.R., Lykke-Olesen, A.: Reclaiming public space: designing for public interaction with private devices. In: 1st International Conference on Tangible and Embedded Interaction (TEI 2007), pp. 31–38. ACM, New York (2007)
3. Lave, J., Wenger, E.: Situated Learning: Legitimate Peripheral Participation. Cambridge University Press, Cambridge (1991)
4. Bowles, M.S.: Relearning to E-Learn: Strategies for Electronic Learning and Knowledge. Melbourne University Press, Melbourne (2004)
5. Canova Calori, I., Divitini, M., Eljueidi, M.: A design framework for city-wide collaborative learning systems. In: 8th World Conference on Mobile and Contextual Learning (mLearn 2009), Orlando, Florida, USA (2009)
6. Olsen, P.B., Pedersen, K.: Problem-Oriented Project Work – A Workbook. Roskilde University Press, Roskilde (2005)
7. Topolinski, S., Reber, R.: Gaining insight into the "Aha" experience. Curr. Dir. Psychol. Sci. **19**(6), 402–405 (2010)
8. Kluszczynski, R.W.: Strategies of interactive art. J. Aesthet. Cult. **2**(1) (2010). https://www.tandfonline.com/doi/abs/10.3402/jac.v2i0.5525
9. Michelis, D., Müller, J.: The audience funnel: observations of gesture based interaction with multiple large displays in a city center. Int. J. Hum.-Comput. Interact. **27**(6), 562–579 (2011)
10. Lombard, M.: Intercoder reliability (2010). http://matthewlombard.com/reliability/
11. Foucault, M.: Madness and Civilization: A History of Insanity in the Age of Reason. Vintage Books/Random House, New York (1988). Foucault quoted in Dreyfus, H.L., Rabinow, P.: Michel Foucault: Beyond Structuralism and Hermeneutics, 2nd edn. p. 187. University of Chicago Press, Chicago (1983)
12. Flanagan, J.C.: The critical incident technique. Psychol. Bull. **51**(4), 327–358 (1954)
13. Lincoln, Y.S., Guba, E.G.: Naturalistic Inquiry. Sage, Beverly Hills (1985)
14. Glaser, B., Strauss, A.L.: The Discovery of Grounded Theory: Strategies for Qualitative Research. Aldine de Gruyter, New York (1967)
15. Casement, A.: Who Owns Jung?, p. 23. Karnac Books, London (2007)
16. Roberts, R.M.: Serendipity: Accidental Discoveries in Science. Wiley, New York (1989)
17. Cobbledick, S.: The information-seeking behavior of artists: exploratory interviews. Libr. Q. **66**(4), 343–372 (1996)
18. Foster, A.E., Ford, N.: Serendipity and information seeking: an empirical study. J. Doc. **59**(3), 321–340 (2003)
19. Oliveira, N., Oxley, N., Petry, M.: Installation Art in the New Millennium. Thames & Hudson, London (2003)

20. Gaver, W.W.: Technology affordances. In: Proceedings of CHI 1991, pp. 79–84 ACM, New York (1991)
21. Gibson, J.: The Ecological Approach to Visual Perception. Houghton Mifflin, Boston, USA (1979)
22. Norman, D.: The Psychology of Everyday Things. Basic Books, New York (1988)