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Adaptive Ephemeral Interiority: Upcycling Site Specific Interiors

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Abstract

Adaptive reuse in architecture refers to the process of redesigning, converting, and reappropriating existing spaces for functions different from the ones they were originally designed for. This research is a case study showing an alternative to this concept, re-purposing aviation parts and finding new programmatic functions in the design learning studio. The pedagogy approach, adopted by a design studio in the United Arab Emirates (UAE), presents the fluidity of adaptive interiority against rigidity and site specificity. The research results in the creation of adaptive modular spaces and ephemeral interiority through upcycling design, flexibility, materiality, reusability, recyclability, and connectivity while simultaneously showcasing the rigorous interplay of innovation, research, science, and technology. The case study design studio was based at Zayed University and partnered with Etihad Airways, the national carrier of the UAE, highlighting the importance of industry and education as interdisciplinary collaborations. The paper looks at the pedagogical approach and examines the conducted process and evaluates the outcomes and shortcomings, including those inflicted by the COVID-19 world health pandemic. It argues for 'adaptive interiority,' inclusion in the adaptive reuse framework and a further reflection on the large vision and possible future impact within the UAE's social and architectural context.

Keywords: adaptive interiority, spatial design, repurposing aviation parts, ephemeral interiority, upcycling design

Introduction

The objective of this research was to test a pedagogy approach which allows students of interior design to engage in adaptive interiority and ephemeral design by exploring 'design by making' as a learning process that inspires students to fabricate and contribute to sustainability and the reduction of waste. The research addresses the functionality, materiality, sustainability, and constructability of the concept of adaptive interiority and ephemeral design in the United Arab Emirates (UAE), where 70% of solid waste is generated from the construction industry (Swain, 2021).

The UAE has experienced an immense transformation coupled with international recognition, primarily in construction and spatial transformation on the urban, architectural, and interior scale. The surge of fast development and globalisation is accompanied by consumerism trends. This is evident in the individuals' behaviour and also reflected in the speed at which various interior spaces are changed and remodelled. The proposed research aims to question the usability of abandoned and discarded interiors and calls to identify opportunities and explore the notion of UAE's adaptive interiority. The aim is to provide design solutions by exploiting interior design spaces utilising ephemeral mobile structures adapted into a new programmatic function. The proposed adapted industrial furniture and equipment can effectively reduce construction waste in the UAE.

The presented case study responds to this problem through a studio project. It explores two design theories that are intrinsically connected: a) adaptive interiority as a method of upscaling site-specific interiors into another interior context, and b) non-permanent architecture as a response to permanency.

The proposed design was set to be integrated into various design studios at the College of Arts and Creative Enterprises (CACE) for intermediate students. The studio allowed students to learn the design-build process using adaptive materials and an adopted environment. Materials consisted of recycled, site-specific aeroplane interiors, and adaptable structural members to fabricate a new spatial environment within the community and to further develop into an ephemeral mobile structure. The involved students were immersed not just in the design and build process but also learned how to adapt and decontextualise materials, therefore adding to their skills as they prepare to enter the creative industry.

In the UAE, a large amount of construction waste is generated while interior spaces are constantly either in flux or evolving. Examples include retail, F&B shops, offices, and event venues; expansions and additions. These interior spaces create an unnecessary amount of construction waste. The issue is not a regional problem. As humanity steps up to battle climate change, the problem of construction industry waste is commonly found around the globe (US Department of Transportation, 2016).

Yates (2013) stated that "The worldwide construction industry consumes the highest amount of raw materials" (p. 282). There are three main waste minimisation strategies used in construction projects (Ferguson, 1995). These were avoiding waste, re-using materials, and recycling waste. Avoiding waste refers to any practice or process that avoids, eliminates, or minimises waste at the source (Faniran & Caban, 1998). In addition, upcycling is the term often used to describe the process in which used materials are converted into something of higher value and/or quality in their second life (Sung, 2015). This process is often reserved for materials, products, and objects.

The aircraft industry is also a contributor to worldwide waste, whereas new alternative methods of aircraft parts production are being developed, such as the inclusion of bamboo parts (Prakasa et al., 2021). There is already a large industry that specialises in recycling aircraft parts. According to Zhao et al. (2021), "retired aircraft can be disassembled to obtain approximately 50,000 large components, of which approximately 20,000 components can be returned to the aviation material market" (p. 3).

The notion of adaptive reuse is prevalent and well documented within Europe and North America. However, "this ideology is not commonly practised in the UAE. Buildings tend to have a life space of 30 to 40 years before being demolished and replaced by new towers" (Sosa & Ahmad, 2021, p. 250). Within the past two decades, there were several initiatives by various academics and professionals. They include restoration projects such as the Sharjah historic centre and heritage area (Picton, 2010) and the Al Faihidi neighbourhood in Dubai (Pathak, 2012); various awareness initiatives on UAE modern architectural history by the Abu Dhabi Department of Tourism and Culture ("Tangible & intangible," n.d.; "Modern heritage," n.d.); several academic initiatives and publications such as Abu Dhabi Guide by Pascal Menoret (Kappler, 2014); research work conducted by Yasser Elsheshtawy (<https://uaemodern.com/>) and publications by Katodrytis and Mitchell (2015); exhibitions and books series such as

Lest we Forget UAE initiative ("Lest we forget," 2015); and partnerships such as Zayed Institute for Architecture, Heritage, and Arts launched in 2019 by The Ministry of Culture and Knowledge Development in partnership with Zayed University (Alghoul & Salman, 2019).

Internationally, there are few examples of successful practices that recycle and upcycle aviation parts, appropriating them to various alternative household uses. One example of such practice is MotoArt Studios founded in the United States in 2001 ("Featured products," n.d.; Mohn, 2018). The presented case study distinguishes itself through the way interior and furniture aviation pieces are used as means to design and define the spatial interiority, from micro to macro scale. Arguably, though taking a different angle and approach, it is on par with several architectural schools of thought that regard details as the essence and driving force of the overall space design.

The application context in our research study embodies extracting whole internal components from one condition and being used in a different environment. Our proposal brief redesigns existing passenger aircraft systems and aims to address all of these by proposing adaptive modular spaces, therefore challenging construction rigidity and site specificity. For our study, we collaborated with Abu Dhabi's national airline, Etihad Airways. We utilised aviation interior equipment, aircraft connections and parts, and construction waste to reconstruct new spaces that provide alternative architectural interiority programs.

Figure 1
Mass storage
surplus of outdated
passenger aircraft
interior equipment
(Photographs by
authors)



Etihad Airways has spare parts of older aircraft interiors to be discarded as waste after expiring the required statutory period of storage. The research commenced with design proposals readapting the aeroplane interior spare parts into an interior space within the campus site that will house three functions: lounge area, informal working, and exhibit space. The research aimed to understand the

building elements, materiality, and connection system, to utilise a methodology to transform, connect, disjoint, and readapt the different parts to suit the new space and function.



Figure 2
Example of collected
commercial aircraft
interior pieces for
the study (Images
and photographs by
authors)

Contextualisation

Adaptive interiority and ephemeral design are particularly relevant to the United Arab Emirates. Upon the discovery and commercialisation of oil and gas, the UAE has undergone a rapid socio-economic change (Anthony, 1975). The construction industry, including commercial interiors, is constantly either in flux or evolving, going through cycles of construction and demolition. Over the years, several strategies, regulations, studies, reports, and schemes have been devised to evaluate UAE's construction and demolition waste (CDW) (Gernal et al., 2020).

The presented research case study took place at Zayed University, a federal gender-segregated institution for higher education that follows the American liberal arts college system ("About the university," n.d.). Initiated, organised, and led by the authors, 18 Emirati female students actively participated in the adaptive interiority research project. The case study was formalised as part of the intermediate interior design works. In addition to fulfilling the course learning outcome, the pedagogy approach extended to introduce students to adaptive reuse concepts within the UAE region.

In 2020, Etihad Airways announced:

the national airline of the United Arab Emirates, it has partnered with artists and designers to reuse discarded materials from obsolete aircraft cabin interiors toward creating public installations. These materials encompass discarded carpet and fabric rolls, emergency equipment,

sidewalls and windows and Etihad's Economy and Business class seats. (Herrmann, 2021, p. 1)

Spearheaded by the authors who saw a pedagogical opportunity, an MOU was signed between Zayed University and Etihad Airway, charting the commencement of a two-year research design case study.

The study's main significant contribution is envisioned to be in helping build a cohesive society, preserve identity, and create a sustainable environment and infrastructure, excellent education system, and a competitive creative economy. Specifically, the design research proposals directly addressed and contributed to focus on:

- the architecture and urban design to create environmentally friendly living spaces capitalising on social, cultural, and environmental assets within the UAE to develop unique and contemporary designs in architecture and interiors ("The science, technology," 2021);
- the innovation, research, science, and technology which will form the pillars of a knowledge-based, highly productive, and competitive economy, driven by entrepreneurs in a business-friendly environment where public and private sectors form effective partnerships ("Education and Vision," 2021).

The main objectives for the design research study are:

- a) to set a precedent for the students that design goes beyond the classroom, as the design and build experience has an effective outcome;
- b) to set a precedent in multi-collaboration between Zayed University, its students, the local community, and industry partners (Etihad Airways);
- c) to communicate fabrication technologies, adaptive material, and appropriated space to participants who can observe, question, and analyse, leading to a new language and solutions within those parameters;
- d) to establish a learning process by designing, creating, assembling, and producing, and to instigate curiosity of knowledge in the students by familiarising themselves with techniques and tools as a precedent for their colleagues;

- e) to fabricate two 1:1 prototype structures with students to learn about material, adaptive use, technologies of assembly, fabrication techniques, and design process. The experience will allow the participating students to see a project realised from conception to completion. There is a large difference between making small, scaled models and a 1:1 prototype. The opportunity allows participants to learn about cutting, fitting, construction and assembling. Interior designers design for the built environment we occupy on a human scale. The recursive implementation and gradual gain in knowledge will equip the participants with the necessary tools to be initiators, creators, makers, and disseminators of production culture.



Figure 3
Example of devised process from the survey, measuring, representation and design proposal (Image and photographs by authors)

Adaptive Environments: Brief Overview

The notion of adaptation has been repeatedly used in many settings across the globe to describe and rationalise novice contexts within old or existing settings. Bullen (2007) described it as "the process that keeps as much as possible of the building originality at the same time, upgrading the performance to fit the modern standard and shifting users' requirements" (p. 21). Douglas (2006) reasoned existing buildings' conversions, "adaptation is needed so that the user continues to make beneficial use of the property over the long term" (p. 7). Adaptive interiority implies the alteration of the original function and use. Many others define it as repurposing sites, buildings or spaces for uses that totally differ that their original ones, and advocate associated economic, social, cultural, and environmental benefits (Department of the Environment and Heritage, 2004). Despite the terminologies, such as remodelling, retrofitting, conversion, adaptation, reworking, rehabilitation or refurbishment, have quite often been used interchangeably with 'adaptive reuse' (Machado, 1976; Markus, 1979; Giebeler, 2009). Over time, the definition has been connected to changes in functionality and its impact in the future. "Adaptation and reuse is very much part of the

wider debates about the sustainability of the urban environment. It is in line with one of the 21st-century grand- or metanarratives" (Brooker & Stone, 2018, p. viii/1). Contemporary theories on adaptive reuse between 1970 up to today in the field of heritage conservation and architecture identified three main approaches: typological, technical, and architectural (Plevoets & Van Cleempoel, 2011).

The idea of adaptability or flexibility has existed throughout time. It clearly anchors the philosophy behind traditional Japanese house measurement, where the distance between column centres (known as Ken) is 900mm x 1800mm, making them very flexible for changing partitions (Schmidt et al., 2016). Joseph Paxton's Crystal Palace (1851) followed a similar approach, setting up its own standardised Victorian parametric modulation (Paxton, 1994).

Technology has enabled manufacturing to shift away from large-scale mass standardised production toward a network of small-scale craft makers. These makers use digital technologies coupled with manufacturing machines to rapidly prototype and tailor products that were not previously possible for small companies and individuals. The research approach uses a prefabricated system, 'tailor-made' for a perfect fit environment, such as an aircraft interior, and adapts to new environments. Previous prefabricated examples in architecture include but are not limited to the *Su-Si House* (1996) by Oskar Leo Kaufmann (Su-Si house, n.d.), *iT house* (2005) by Alan Koch (Koch, n.d.), and *M-house* (2002) by Tim Pyne (Armstrong, 2009).

Although the examples mentioned above differ in their build-up approach and assembling process, they all departed from the known concept of in situ-site construction, thus challenging its methodology and procedures. Backed by the economical drive and technological advancement specific to their time, they explored the concept of ready-made, off-the-shelf, and kit-built houses. This notion shuffled the hierarchy of the design and build-up process, brought it to the controlled environment of the manufacturing factory, and gave its occupant an element of choice in selecting the assembled parts. The presented study process is a rigorous implementation of research through design to generate new knowledge. The design process is influenced by the parameters set by the materials, used software and scripting language, available hardware within the premises, and authors' and participants' technical and design knowledge (Zimmerman & Forlizzi, 2014).

The design research proposal seeks to understand and familiarise ourselves with these approaches. We believe that we are in an era

of learning, experimentation, adaptation, and appropriating the use. We see the design research proposal as an initiative within the UAE community and design education.

The work carried out in the architecture of Anna Heringer (Heringer, 2018) and Eike Roswag (Heringer & Roswag, 2008) in Bangladesh is an exemplary example. The construction of the Modern Education and Training Institute (METI) demonstrates a strategy to communicate and develop knowledge and skills within the local population gathered from the understanding of their existing cultural, economic, and religious attitudes (Lim, 2007).

Other approaches to materials use proprietary construction systems applied using 'loose-fit' by Maurice Mitchell in 2003 (Mitchell & Tang, 2018) or *OpenStructures* by Thomas Lommée in 2015 (Berthier, 2015). These approaches were based on work developed by British architect Cedric Price with the projects such as the interaction centre in London in 1977 (Price, 1984) and Jean Prouvé with his extensive use of prefabrication methods to construct low-cost housing (Bignon et al., 2001).

Adaptive Reuse Design Learning Process

The design studio was integrated as part of the Furniture for Interior Design course. The course is integrated with a part of lectures and a part of a design studio course for the Bachelor of Fine Art in Interior Design at the College of Arts and Creative Enterprises. The participants were 18 Emirati national female students from the Abu Dhabi campus, Zayed University. The initial task was to bring the pieces from the warehouse, where they were stored, to campus. This process was further challenged by the immanent national lockdown due to the start of the COVID-19 health pandemic in Spring 2020. The exercise was a logistical orchestration of various entities to make sure the pieces were transported safely and undamaged. Prior to transportation, the pieces were categorised to produce a schedule of the objects defined by size, materials, and use.

Once in place, the design brief was set for the participating students to have access to the pieces and start the process of measuring, mapping, and surveying. There is already extensive existing, readily available technical literature about the pieces on the internet. As designers, who believe in the value of understanding materiality, scale, and human proportion, it was decided to get the students to measure, investigate, break, repair, draw, and record the pieces. This process would allow them to create material 'bonding' with the pieces. Interacting with the pieces, seeing them outside their

originally designed context and estimating what the pieces were used for allowed the participants to start 'reimagining' potentials and possibilities for the pieces. Some pieces were obvious such as galleys and toilets, and others were more ambiguous such as overhead lockers and first-class suites.

Design Learning Methodology

The furniture design studio project addressed the functionality, materiality, sustainability, and constructability of adaptive interiority and ephemeral design. As said, the studio project explored two design theories that are intrinsically connected: a) the idea of adaptive interiority as a method of upscaling site-specific interiors into another interior context, and b) investigating non-permanent architecture as a response to permanency. Both methods represented fluidity of design adaptation against rigidity and site specificity.

The planned design was integrated into the furniture design studio. This allowed students to learn the design-build process using both adaptive materials and an appropriated environment. Proposed materials consisted of both recycled, site-specific aeroplane interiors, and adaptable structural members to fabricate a new spatial environment within the community and potentially to further develop into an ephemeral mobile structure. The involved students were to be immersed not only in the design and build process but also in learning how to adapt and decontextualise materials, therefore adding to their skills as they prepare to enter the creative industry. The learning process consisted of three phases—design, develop, and deliver.

The design phase included research, mapping, surveying, and drawings. Students were asked to work in groups of three or four and accordingly identify a name for their respective group. The name became their brand. Students were asked to look at case studies for adaptive reuse and interiors that have been retrofitted into new interiors and functions. Each group was to choose Etihad Airways items for their project to begin their research and design to draw out their conceptual ideas. Effectively, students would record, measure, draw, and 3-dimensional scan their items utilising drawings and models. They were to dissect the items to understand materiality, structure and construction techniques and systems. Submission requirements consisted of 2- and 3-dimensional orthographic drawings and models. Questions were to be asked, including: What are the elements and tectonics that make up the pieces? What are their properties?

In the second phase, students were asked to produce a 1:5 scaled model incorporating their selected Etihad Airways pieces. The intention was to study and represent the elemental properties. Students were to eventually build their piece in a 1:1 scaled space, to have an adaptive modular space through technology, flexibility, materiality, reuse, recyclability, and connectivity.

The third phase consisted of producing and delivering post-production models, a book relaying the story and bringing together the entirety of their designed project. Due to the COVID-19 pandemic, the furniture design studio had to be modified and adapted by deferring a 1:1 scale space to be incorporated as part of a studio class that is to be offered in Spring 2022.



Figure 4
Example of aeroplane
seat adaptation (Image
and photographs by
authors and students)

Research and Case Study Exercise

As a group, students selected two or three objects to conduct a first-hand analysis by observing, testing, drawing, and analysing the furniture pieces. Further research was also applied to understand the history, tectonics, materiality, and construction. The research was implemented in several ways. First, students considered case studies (adaptive reuse and retrofitted interiors), researched aviation (planes, parts, and furniture), and ascertained pieces for their project. Second, students recorded, measured, drew (utilising drawings and models), and scanned their pieces (utilising a 3D scanner). Third, students dissected the pieces to understand materiality, structure, and construction systems to question the tectonics and properties that make up the pieces.

They also examined case studies of adaptive reuse and interiors that have been retrofitted into new interiors and functions. They selected and thoroughly researched their chosen case study by identifying the various elements of the space design and, consequently, that piece of furniture in the space. They conducted a thorough analysis portraying a holistic understanding of design. They experimented with graphical means to study and analyse the different aspects of

how the furniture pieces manifested themselves in space. Questions and responses addressed the following criteria:

- Content and context: How is furniture integrated into the space? How does it respond to site parameters? How is it integrated with spatial program parameters?
- Usage, activity representation, and human postures: What is the furniture used for? What activities does the furniture initiate or generate in the space? What are the different forms of user interactions with the piece/pieces of furniture?
- Materiality, manufacturing process, and details: What is the furniture made of? How is the piece detailed? How do we determine tectonics, specific materiality, and joint details?

They had to reflect on the space typology, overall functionality, and users. They also conducted a general case study for furniture by using reading material and the questions above as guidelines; they expanded and analysed their work. Once the research and case study exercise was completed, students underwent a specified and site-specific furniture exercise.

Specified and Site-Specific Furniture Exercise

The project challenged students to design site-specific furniture to accommodate various activities in a selected location at the Zayed University campus. The furniture pieces served functionally and aesthetically to the existing environment found on campus. The design should consider all existing site parameters such as orientation, activities, light, materiality, tectonics, views, and the like. The vision was to propose a forward-looking, innovative and creative design proposal for a piece of furniture and work out the furniture. The piece was site-specific and considered how it fits and responds to the space. To understand how the Etihad Airways items can be envisioned to adapt to new spaces and functions, students had to start researching specified universal furniture and apply them as part of a familiar space at Zayed University. This exercise was split into two parts.

For the first part, each student identified at least one furniture supplier and included the detailed information as part of a specification sheet. Each student needs to find a unique supplier that provides customised rather than generic specifications. For the second part, students proposed an alternate furniture layout for an interior design office. The site was two classrooms merged into one, separated by a storage room. This was a familiar and accessible space

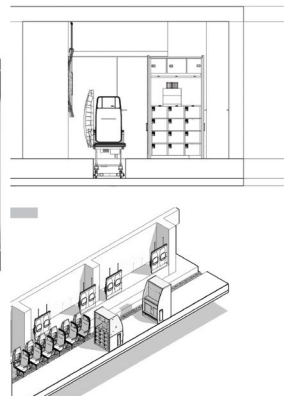
for the students to work from. They were requested to refurbish the space to accommodate the change in functionality. They were not redesigning the space; this was purely a space planning exercise. Therefore, all existing wall and floor finish material, as well as ceiling light distribution remained the same. Students converted the classroom space into an interior design office. The space was seen as an entrepreneurial space for young interior design graduates, like themselves, to start their small practice and take the first steps into the professional world. The entrepreneurial interior design office was also seen as a mediating phase where the young interior design professional graduates under the mentorship of dedicated faculty and professionals for a defined period before independently opening their own practice.

They began by deciding on the number of people the entrepreneurial space could accommodate and eventually collectively brainstormed the necessary functions and zones. It was entirely up to them to redefine the function of the office space. The university, an imaginary client, was only interested in refurbishing and not redesigning the interiors. They accommodated the newly proposed function in the best way possible by laying out specified furniture and space planning.

The recommended working steps that students had to adhere to were to adopt existing drawings of the classrooms while every space parameter was to remain the same. Students were to brainstorm, sketch, and plan the functions, activities, and layouts for this entrepreneurial office. They were to utilise a specification sheet to identify suitable suppliers. Students were also asked to identify, select, and source different furniture pieces that best fit the proposal by visiting websites and contacting the suppliers as needed within the country. Upon selection, students were asked to source the detailed product information by ensuring accurate product representation such as selected products, size, and aesthetic appearance that work together and result in a coherent space layout proposal. Students were to produce a series of drawings and 3D visuals of their new space proposals, ensuring to tag and annotate all furniture pieces and reference them to the schedule and specifications. Students were asked to create a furniture schedule and ensure to reference all the products on the drawings. They effectively collated a product specification sheet and finally presented well-laid-out drawings.

Ideas and Peculiarities

Students were arranged into four groups and came up with different proposals to explore adaptive ephemeral interiority by adopting the Etihad Airways items as part of Zayed University's campus.



Marco Sosa, Lina Ahmad, Karim Musfy

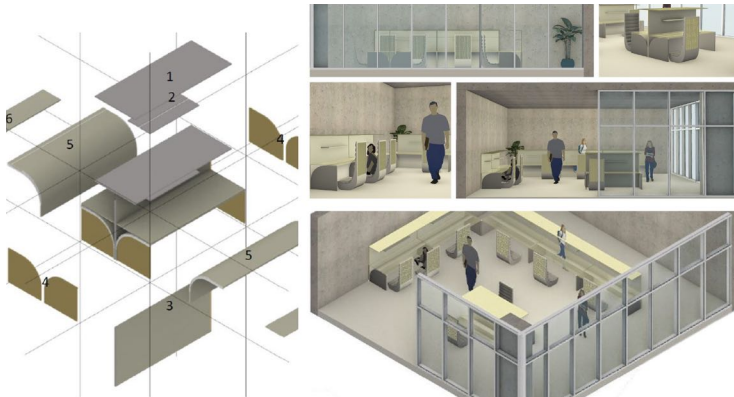


Figure 6
An isolation cabin constructed by the aircraft galley and seat (Image by Gray Group students: Ashia Almansoori, Ayesha Alhammami, Mahra Albloushi, Nora Alnahdi, Mouza Almheiri)

The Kago Group proposed to replace an existing shop on campus found in the promenade area, providing the necessary program as per research and data collection conducted on campus. The idea was to transform the aircraft stowage, unit bar, and seat to provide a customised and tailored unit that includes a bookshelf, partition, tabletop, and seating area for studying (Figure 7). This group learned the importance of a sustainably adaptable unit prefabricated into a simple yet complex functional piece.



Figure 7
The adaptation of
aircraft stowage, unit
bar, and seat for a
study space (Image
by Kago Group
students: Maha
Almansoori, Reem
Alaydroos, Reem
Alraeesi, and Shareefa
Aljaberi)



The proposal of Rush Group was to occupy the library on campus, providing the necessary program as per research and data collection conducted on campus. The idea was to transform the first-class seat to provide a tailored and isolated unit serving the inside and outside differently, including a bookshelf, reclining chair, television screen, and table for studying (Figure 8). Lessons learned by this group were that detailed and design connections were necessary to properly be manifested into a viable built structure with minimal compromises.

Reflection on Deployed Framework

Now that the phases of research, case study, specified and site-specific furniture exercise, and ideas development are completed, students have enough material to transition into the design and built final stage, which is planned to be offered in the Spring 2022 semester as part of a collective studio, furniture design, and environmental design classes. The success of the experience is echoed in selected student quotes:

We collaborated with Etihad Airways, adapted old plane pieces, reused them, and changed their functions. It was a good experience because it was the first time we worked and looked into pieces rather than a site or a building. We conducted first-hand analysis by observing, testing, and drawing. We also looked into aeroplane's history, tectonics,

materiality, and construction. We came up with different innovative and creative designs for the pieces integration within the space we selected. (Mouza Almheiri, Gray Group)

My team and I learned something special, different and unique in this studio. It was challenging and complicated, especially at the beginning. We learned how to think about unconventional ideas through learning from researched information and case studies. This has helped us to draw the details, connect them to our design ideas and form the spatial interventions. Also, I really enjoyed working in a group towards producing solid and beautiful work. (Aisha Almessabi, 1964 Group)

It was a great experience and a very different one! We had to work on the Etihad aeroplane pieces and conduct in-person experiments. (Reem Al Zandani, Rush Group)



Figure 8
The transformation of the first-class seat into an isolated study unit (Image by Rush Group students: Haya Almazrouei, Maitha Alketbi, Mariam Alblooshi, Reem Alzandani, and Zahra Alzarooni)

The peculiarities among managing across students' expectations, unfamiliar structures, academic rules and regulations, pandemic restrictions, and deadlines became a challenging yet stimulating way to evolve and shape the studio class. The journey from identifying the Etihad Airways pieces in a warehouse to logistically transporting them to campus, to incorporating them into a studio curriculum during the pandemic peak served as a learning lesson in preparation for the next design and built stage. The pandemic itself instigated the authors to rethink design education, not only through implementing the known but also by discovering new potentials within the interior design pedagogy (Ahmad et al., 2020).

The presented case study is on par with many conducted design explorations within pedagogical settings. Its uniqueness stems from UAE contextual settings, where the followed norm is disposing and replacing with brand-new elements at the furniture scale or demolishing and rebuilding at the building scale. The authors utilised Etihad airline parts as a response to a current practical context where spare parts in aviation warehouses could no longer be used for their original purpose as they no longer fitted the aircraft used models. Through this initiative, the authors successfully extended the learning beyond the classroom boundaries and allowed students to respond and interact with a present regional phenomenon. This initiative introduced the young generation to the notion of adaptive reuse and thus followed a bottom-up approach in spearheading a message within the future community, as well as taking part in commemorating and preserving a part of national aviation history.

The case study pays particular attention to detail and furniture scale to celebrate direct human interaction with design-optimised interior elements and furniture pieces. It also further expands the room boundaries and its spatial conditions, thus curating the program and performed activity, as well as articulating and directing the overall spatial interiority.

The biggest shortcoming of the study is the theoretical design learning approach. Even though the work commenced with the intention of fully realising selected design proposals, the international COVID-19 health pandemic enforced lockdown closures to the campus and facilities. This was the main factor that impeded the project. Despite the building element being compromised, the students still had a sense of reality via in-person inspection visits of the selected aviation parts. They were required to consider the various technical elements, such as connection, used materiality,

assembling, and construction methods and electrical lines and pipe, as design parameters and drivers for their design proposal.

While the initial focus was the development of adaptive interiority in static and mobile settings, the study also increased and articulated design and assembly skills for the participating students. The study benefited from empowering participants and developing a sense of community around design and production. The intention is to utilise a design-oriented approach driven by the local community and industry, utilising global knowledge and design by making approaches. Creative works that are developed with the community contribution are an expected output, along with associated academic dissemination.

This valuable experience within a culturally site-specific classroom can effectively generate alternative geo-cultural outcomes under other contexts. The design by making studio can serve as a shared studio across international universities engaging students from various parts of the world in a collective adaptive design while attempting to validate the reduction of construction waste.

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References

- About the university.* (n.d.). Zayed University. Retrieved September 30, 2021, from https://www.zu.ac.ae/main/en/explore_zu/index.aspx
- Ahmad, L., Sosa, M., & Musfy, K. (2020). Interior design teaching methodology during the global COVID-19 pandemic. *Interiority*, 3(2), 163–184. <https://doi.org/10.7454/in.v3i2.100>
- Alghoul, R., & Salman, N. (2019, April 14). *Ministry of Culture launches project to promote architecture in UAE.* <http://wam.ae/en/details/1395302755198>

Anthony, J. D. (1975). The impact of oil on political and socioeconomic change in the United Arab Emirates. In J. D. Anthony (Ed.), *The Middle East: Oil, politics, and development* (pp. 79–98). AEI Press.

Armstrong, P. J. (2009). Transforming the invisible hand: Redefining the machine-made house. In P. Clouston, R. K. Mann, & S. Schreiber (Eds.), *Without a hitch: New directions in prefabricated architecture* (pp. 212–220). Lulu Press.

Berthier, S. (2015). Timber in the buildings of Jean Prouvé: An industrial material. *Construction History*, 30(2), 87–106. <http://www.jstor.org/stable/44215909>

Bignon, J. C., Ferrier, J., & Zennaro, P. (2001). *Jean Prouvé constructeur: 1901-1984*. Réunion des Musées Nationaux.

Brooker, G., & Stone, S. (2018). *Rereadings 2: Interior architecture and the design principles of remodelling existing buildings*. RIBA Publishing.

Bullen, P. A. (2007). Adaptive reuse and sustainability of commercial buildings. *Facilities*, 25(1/2), 20–31. <https://doi.org/10.1108/02632770710716911>

Department of the Environment and Heritage. (2004). *Adaptive reuse: Preserving our past, building our future*. <https://www.agriculture.gov.au/sites/default/files/documents/adaptive-reuse.pdf>

Douglas, J. (2006). *Building adaptation*. Routledge.

Education and vision 2021. (2021). United Arab Emirates. <https://www.vision2021.ae/en/publications>

Faniran, O. O., & Caban, G. (1998). Minimizing waste on construction project sites. *Engineering, Construction and Architectural Management*, 5(2), 182–188. <https://doi.org/10.1108/eb021073>

Featured products. (n.d). MotoArt. Retrieved May 21, 2021, from <https://www.motoart.com/>

Ferguson, J. (1995). *Managing and minimizing construction waste: A practical guide*. Thomas Telford.

- Gernal, M. L., Sergio, R. P., & Musleh, A. J. (2020). Market driven by sustainable construction and demolition waste in UAE. *Utopía y Praxis Latinoamericana*, 25(2), 56–65. <https://dialnet.unirioja.es/servlet/articulo?codigo=7412966>
- Giebeler, G. (2012). Definitions. In G. Giebeler, R. Fisch, H. Krause, B. Lenz, F. Musso, & A. Rudolphi, (Eds.), *Refurbishment manual: Maintenance, conversions, extensions* (pp. 10–15). Birkhäuser.
- Heringer, A. (2018). Anna Heringer Architecture. In S. Hofmeister (Ed.), *My Bauhaus–Mein Bauhaus* (pp. 26–27). DETAIL. <https://doi.org/10.11129/9783955534523-008>
- Heringer, A., & Roswag, E. (2008). *The school made of earth and bamboo, Rudrapur, Dinajpur District, Bangladesh, 2005*. World Architecture.
- Herrmann, M. (2021, February 22). *Etihad airways' project is turning old aircraft parts into repurposed art*. Forbes. <https://www.forbes.com/sites/micheleherrmann/2021/02/22/etihad-airways-project-is-turning-old-aircraft-parts-into-repurposed-art/?sh=5467bfc3470a>
- Kappler, B. (2014, December 7). *A study of modern architecture in Abu Dhabi, 1968-1992*. NYUAD. <https://nyuad.nyu.edu/en/news/latest-news/arts-and-culture/2014/december/a-study-of-modern-architecture-in-abu-dhabi-1968-1992.html>
- Katodrytis, G., & Mitchell, K. (Eds.). (2015). *UAE and the Gulf: Architecture and urbanism now*. Wiley.
- Koch, A. (n.d.). *Alan Koch Architecture*. Retrieved September 30, 2021, from <https://alankocharchitecture.com/>
- Latham, D. (2016). *Creative reuse of buildings: Volume one*. Routledge.
- Lest we forget: Emirati adornment: Tangible & intangible*. (n.d.). warehouse421. https://www.warehouse421.ae/en/media/gallery/lest-we-forget_1/
- Lim, J. C. (2007). *Hand-made school, Rudrapur, Bangladesh*. Aga Khan Award for Architecture. https://www.akdn.org/sites/akdn/files/media/documents/akaa_press_kits/2007_akaa/school_in_rudrapur_-_bangladesh.pdf

- Machado, R. (1976). Old buildings as palimpsest: Toward a theory of remodelling. *Progressive Architecture*, 11, 46–49.
- Markus, T. A. (Ed.). (1979). *Building conversion and rehabilitation: Designing for change in building use*. Butterworths.
- Mitchell, M., & Tang, B. (2018). *Loose fit city: The contribution of bottom-up architecture to urban design and planning*. Routledge.
- Modern heritage*. (n.d.). Abu Dhabi Culture. Retrieved September 6, 2021, from <https://abudhabiculture.ae/culturall/en-article/modern-heritage/>
- Mohn, T. (2018, July 16). *From the sky to your home, plane parts get a second life*. The New York Times. <https://www.nytimes.com/2018/07/16/business/airplane-parts-recycling-furniture.html>
- Pathak, S. (2012, April 14). *Dubai aims to protect 220 historic buildings by 2016*. Gulf News. <https://gulfnews.com/entertainment/arts-culture/dubai-aims-to-protect-220-historic-buildings-by-2016-1.1008142>
- Paxton, J., & Fox, C. (1994). *Crystal Palace*. Phaidon Press.
- Picton, O. J. (2010). Usage of the concept of culture and heritage in the United Arab Emirates—an analysis of Sharjah heritage area. *Journal of Heritage Tourism*, 5(1), 69–84. <https://doi.org/10.1080/17438730903469813>
- Plevoets, B., & Van Cleempoel, K. (2011). Adaptive reuse as a strategy towards conservation of cultural heritage: a literature review. *Structural studies, repairs and maintenance of heritage architecture XII*, 118(12), 155–163. <https://doi.org/10.2495/STR110131>
- Prakasa, L. R., Firmansyah, M., Al Hadi, P. F., & Hariyanto, K. (2021). The utilization of bamboo waste as a new alternative material in the aircraft fuselage interior panel structure. *Vortex*, 2(1), 30–38. <https://doi.org/10.28989/vortex.v2i1.932>
- Price, C. (1984). *Cedric Price (works)*. Architectural Association.
- Schmidt III, R., & Austin, S. (2016). *Adaptable architecture: Theory and practice*. Routledge

Sosa, M., & Ahmad, L. (2021). Urban portraits: Preserving the memory of modern architectural heritage in the United Arab Emirates. *In Urban modernity in the contemporary gulf: Obsolescence and opportunities*. (pp. 246–261). Routledge. <https://doi.org/10.4324/9781003156529>

Su-Si house. (n.d.). Retrieved September 30, 2021, from <http://www.jkarch.at/projekt/su-si>

Sung, K. (2015). *A review on upcycling: current body of literature, knowledge gaps and a way forward* [Conference session]. The 17th International Conference on Environmental, Cultural, Economic and Social Sustainability (ICECESS), Venice. https://irep.ntu.ac.uk/id/eprint/12706/1/219287_PubSub1825_Sung.pdf

Swain, S. (2021, May 16). *Construction wastes management in the UAE*. EcoMENA. <https://www.ecomena.org/construction-waste-uae/>

Tangible & intangible heritage. (n.d.). Department of Culture and Tourism. Retrieved September 6, 2021, from <https://tcaabudhabi.ae/en/what.we.do/culture/tangible.intangible.heritage.aspx%20Accessed%20%20September%202021>

The science, technology and innovation policy. (2021, October 12). United Arab Emirates. <https://u.ae/en/about-the-uae/strategies-initiatives-and-awards/federal-governments-strategies-and-plans/the-science-technology-and-innovation-policy#:~:text=This%20policy%20aims%20to%20foster,vision%20for%20the%20year%202021>

US Department of Transportation. (2016, September 23). *Bureau of transportation statistics, Municipal solid waste and construction & demolition debris*. Retrieved from https://www.bts.gov/archive/subject_areas/freight_transportation/faf/faf4/debris

Yates, J. K. (2013). Sustainable methods for waste minimisation in construction. *Construction Innovation*, 13(3), 281–301. <https://doi.org/10.1108/CI-Nov-2011-0054>

Zhao, D., Guo, Z., & Xue, J. (2021). Research on scrap recycling of retired civil aircraft. *IOP Conference Series: Earth and Environmental Science*, 657 (1), 012062. <https://doi.org/10.1088/1755-1315/657/1/012062>

Zimmerman, J., & Forlizzi, J. (2014). Research through design in HCI. In J. S. Olson & W. A. Kellogg (Eds.), *Ways of knowing in HCI* (pp. 167–189). Springer. https://doi.org/10.1007/978-1-4939-0378-8_8