Artificial Intelligence (AI) and Unit 4: Artefact

In this support guide for students, we set out considerations you may take when exploring and critiquing the value of generative artificial intelligence (GAI) tools in the "creative industries" that include but are not limited to:

- developing 3D models (physical and digital) for use in manufacturing, sculpture, theatre sets etc
- creating 2D media and artwork (physical and digital) for use by Graphic Designers, video makers, website designers etc
- aiding the creation of all, or part of, technical products for use in consumer products.

Context

GAI is revolutionising many industries including Design, Engineering and the Arts. The creation and fabrication of new artefacts, both physical and digital, have historically been the sole domain of human endeavour. But with recent and widespread availability of generative AI (GAI) technologies that can create images, audio, and the digital files required for physical fabrication, the creation of artefacts can now be complemented by the use of GAI tools as part of the design and make process. Whilst the automation of manufacture linked to software is nothing new, a computer system "designing" a solution is, and presents many possible challenges for these industries, from legal ownership to safety and ethical implications. Similarly, AI generate the criteria against which an artefact will be successful, drawing from closed bodies of data rather than from a human led process, may lead to unethical solutions being created. Whilst innovative applications of GAI are still nascent, both the creative possibilities and potential implications of GAI and their impact on the existing workforce are as yet unclear, and challenges how we perceive the human capability of creativity.

AI:EPQ advice: The **sole use** of AI tools **cannot** meet assessment descriptor requirements set out for the extended project qualification. AI tool use can **appear alongside** and influence **evidence** for which the candidate has independently created (i.e. without the use of AI tools) in order to meet the assessment descriptors. Candidates are required to reference each and every instance of AI tool use within their coursework submission, and failure to do so will be considered malpractice.

Introduction

If you are interested in completing an EPQ in Unit 4: Artefact and are also interested in critically evaluating GAI tools within your assignment, here are some considerations you will need to take when carrying out your project.

1. Developing a working title for a Unit 4: Artefact

The title for a Unit 4 Artefact project should be written in the format of a Design brief

E.g. *'Design and make prototypes for a 3D artefact that will be launched to accompany an exhibition of work from a past civilisation, to be held at the British Museum"*

Whilst you are not permitted to take credit for the creative outputs of a GAI, with appropriate referencing, you can employ GAI as a tool during the process of ideation or during the focused development of artefacts in response to a brief where GAI is an assistive step.

E.g. "Design and prototype 3D artefacts that can accompany an new exhibition of work from a past civilisation

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hosted at the British Museum. Use GAI to provide the inspiration from which you will start."

E.g "Design and prototype an interactive installation for display in the F1 section of the Science Museum. Use GAI to simulate the feedback of a prospective user/visitor to the museum."

In both of the rewritten briefs above, the approach identifies the use of GAI for a specific purpose, for which no credit is expected by the student, because a significant body of work is completed elsewhere within the project. In each of these briefs, the student could increase or decrease the opportunity to critically review GAI technology in the role it has been employed for, which adds a unique dimension to the main focus, on creating an artefact.

Alternatively, you could employ a GAI capable of generating digital fabrication files for computer aided manufacture (e.g. 3D printing, laser cutting/etching, LaserJet printing, etc). These outputs could be used in two different ways

1. Fabricate an artefact solely using the GAI digital file (no human changes applied, and critique (through testing) the outcome alongside your own design and make.

E.g. "Use a generative AI tool to create a set of .stl files of kitchen utensils that you can 3D print, in order to test and critique their functionality alongside a set of tools you design and make to for the same kitchen task."

2. Fabricate an artefact solely using the GAI digital file, (no human changes applied) and then use this made outcome as the starting inspiration for your own design and make project.

E.g. "Use a generative AI tool to create a set of .stl files of iconic sports stadiums in order to quickly critique with a target audience the requirements of a new design, which you then design and prototype a scale model for."

In both instances here, you will need to ensure that you complete your own designing and making, and therefore you are either competing with the design capabilities of the GAI, or you are using the GAIs ability to design solutions, to support early testing, which are both examples of assistive steps requiring referencing.

GAI tools have the potential to generate inspiration research such as images or mood boards, a specification based upon a set of defined requirements, a range of design ideas based of a specification, provide the iterative development or adaptation of generated solutions, and the manufacturing files for certain CAM equipment, through the appropriate prompts. Both utilising any of these potential applications of GAI as an assistive step to a full design and make process, or as part of a critical comparison of the potential for GAIs alongside the same human activities, allows you to meet the requirements of the artefact EPQ, and will require either or both careful title writing and clear referencing to GAI use.

For more guidance on titles, see our titles support guide here.

2. Documenting when and how you use GAI tools

If you are planning to integrate the critical analysis of any use or output from GAI as part of your project, you will need to be explicit during the project write up, which includes a requirement to:

- retain a copy of the question(s) and computer generated content

- record a noneditable format (screenshot) of the question and output
- write a brief explanation of how the GAI has been used

These requirements can be recorded in a text document such as word, and referenced to in your project activity log.

Here are some key questions/milestones to consider when documenting your use of GAI in your project activity log:

- Which GAI(s) are you going to critically review? (Ensure that you reference and evidence your use in a document)
- How did your use of the GAI(s) evolve during your project, and did this inform your own creative activity in any way? (Make sure to document the iteration of your written inputs into the GAI each time)
- What benefit did you personally gain from critically reviewing the GAI tool outputs alongside your own creative work, and what implications might this have for associated creative industries? (Remember to imagine yourself as a designer, engineer or artist, and consider what you have learnt or benefited from through GAI use)
- How do you intend to purposefully evaluate the value of any GAI output or eventually your final design or physical artefact, when comparing your own work to that of a GAI tool? (will you use subjective and objective specification criteria to evaluate against? How will user testing arrive at suitable conclusions to the value of GAI vs human?)
- From your experience of artefact related GAI generated outputs, how will the pace of technological advancement in these GAI tools impact artefact generation and production, now and in the future? (e.g. will humans become obsolete as designers, engineers or artists of artefacts in the future?)

GAI Tools

The following non exhaustive list of GAI tools are capable of generating outcomes associated with a Unit 4 Artefact EPQ.

Image generation:

- Midjourney,
- Adobe Firefly
- DALL·E 3
- Easy Peasy GAI
- NightCafe Studio
- StarryAI
- Toolbaz Ai Script generator

3D object generation and optimisation:

- Meshcapadem
- Luma GAI
- 3DFY GAI
- NeROIC

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- Get3D by Nvidia
- Sloyd.ai

Video generation:

- Pictory
- Synthesys
- Synthesia
- DeepBrain GAI
- Veed.io

Coding:

- GitHub Copilot
- Cody
- Tabnine
- Replit
- GhostWriter
- Mintlify
- ChatGPT

Presentations:

- Canva Magic
- Slidebean
- Tome
- Sendsteps

GAI tool issues to consider

The use of GAI tools are intrinsically linked to potential issues that are a challenge for this evolving technology. Here are some specific Artefact issues that you may wish to consider within your EPQ.

Ethics

A significant issue associated with GAI tools and their ability to be used to generate work, is around ethics. Ethical use of tools, particularly to replicate or replace a human, have wide ranging associated and unanticipated issues, that may be of interest to you in your EPQ, specifically relating to the impact it could have on societal constructs (such as morality, status, cultural norms and behaviours). For example GAI tools can also be used for illegal, nefarious purposes, for example, to create and distribute designs for 3D-printable weapons.

Copyright

The copyright and ownership of creative outputs from designers, artists and engineers, including intellectual property issues, are already issues within the creative and technical industries, where companies try to protect innovations in both hardware and software to stop replication by competitors or by illegitimate organisations operating overseas. The regulation of this can be a significant financial burden to organisations investing in innovation through research and development.

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In instances where GAI tools are asked to recreate the work of an existing designer, engineer or company or draw "inspiration" from genres to create GAI generated outputs, who is the owner of what is created? Is it the GAI tool user, the GAI tool developer, the designer that the GAI tool is impersonating, or another stakeholder, including the GAI company? Furthermore, did the individual or company who is being used as the source material give their permission for the GAI model to learn from their work? Where technical or material innovations are being sourced through free access to information, how are the owners of these innovations able to protect information that is in the public space, irrespective of any legal protections they are able to put in place for humans?

Empathy

GAI tools are capable of following text-based prompts. However, in following prompts, a GAI tool is incapable of identifying or judging the potential impact of their output, in the same way that a human might. These human capabilities include an important social norm, empathy, which affords reflection, perspective and responsibility to an outcome before committing to it. How can GAI tools empathise with a designer, artist, or engineer in the way that a human can, and if it cannot, what potential risks must you as a human consider in its absence? GAI tools can also be used to create seemingly empathetic chat-bots; does prompted empathy lead to potentially dangerous misunderstandings or complacency?

Language/linguistics

Here are some key language and linguistics issues to consider when using GAI tools to co-create artefacts:

Ambiguity - GAI may misinterpret vague, abstract, or implicit language used to describe design goals, for example "better" can be interpreted in many ways: faster, lighter, cheaper, lower environmental impact etc

Context dependence - GAI lacks human context/common-sense so the prompter / designer must provide complete details of the setting.

Connotation - Words can carry cultural meanings GAI doesn't grasp, for example an "organic shape" to a GAI can differ greatly from a designer's intent.

Technical terminology - GAI trained on casual text may not comprehend discipline-specific terms like "kerning" or "draft angle."

Visual/spatial rendering - GAI has difficulty translating text into intended visual qualities like "youthful" or "balanced composition". Many instances of GAI are also capable of generating any images when asked, where the GAI is unaware of the age or its instructor. This could lead to generated outputs of inappropriate age and depiction.

Unpredictable interpretation - GAI is prone to unanticipated (sometimes nonsensical) outputs from initial prompts.

Bias - GAI model biases can lead to exclusions, skewed perspectives, and unfair assumptions.

Data limitations - the GAI output is limited by training data parameters, for example, it may only have data up to 2020 so has missed recent innovations and developments in the associated fields.

An interesting research piece in this field for you to consider (date accessed 18th October 2023)

https://www.sciencedirect.com/science/article/pii/S2590123022001487

Future prospects of computer-aided design (CAD) – A review from the perspective of artificial intelligence (GAI), extended reality, and 3D printing, is a research piece that investigates the opportunities for using GAI in a CAD > VR, AR, and MR > 3D printed workflow. The paper suggests that there are many opportunities for GAI to help optimise the process of generating a range of manufactured products, but there is still much research to be done to move GAI into mainstream acceptance.

Potential design approaches for GAI tools

In order to use a GAI tool to generate an artefact, you will need to know about the basic constructs against which you require the tool to create, so that you can instruct it.

As an example, if you were to use a GAI tool to generate a design, you will need to instruct the GAI tool using the prompts akin to these:

1. **Provide sample images/models of preferred style, form, function as references** for the tool to analyse and emulate. This gives the GAI visual design context.
2. **Feed descriptive text outlining specification prompts** to guide generation, such as: key features, physical properties, usages, etc.
3. **Supply specific technical requirements** including material, size, weight, manufacturing, and performance parameters to constrain and focus the design space.
4. **Iterate on initial GAI-generated outputs** through ratings and selections to steer towards the desired attributes in an evolutionary process.
    a. **Interactive Learning**: Train the GAI using reinforcement learning where the designer provides feedback on generated designs. The GAI learns to improve based on the designer's preferences.
    b. **Reward-based Systems**: Use a reward-based system where the GAI receives positive reinforcement for generating desirable design elements.
5. **Train the model on a dataset** of your own successful past designs to tune it to your unique creative style and domain.
6. **Manipulate the generated design using CAD tools**, rather than just accepting the raw output using a "hybrid workflow." Ensure the GAI provides explanations for its design decisions. This helps designers understand the rationale behind generated designs and build trust in the GAI's capabilities.
7. **Limit the design variables and parameters** provided to gradually increase complexity as needed.
    a. Define constraints for the design, such as budget limitations, target audience preferences, or material constraints, and let the GAI generate designs that satisfy these constraints.

Here is a suitable reference for the ScienceDirect website:

Web Link (URL):

Title: Bonsa Regassa Hunde, Abraham Debebe Woldeyohannes (2022) Future prospects of computer-aided design (CAD) – A review from the perspective of artificial intelligence (GAI), extended reality, and 3D printing

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JCQ Guidance on Coursework Assessment
Please review the rules and guidance relating to the use of GAI within coursework and assessments here:
GAI Use in Assessments: Protecting the Integrity of Qualifications
Information for candidates Coursework assessments