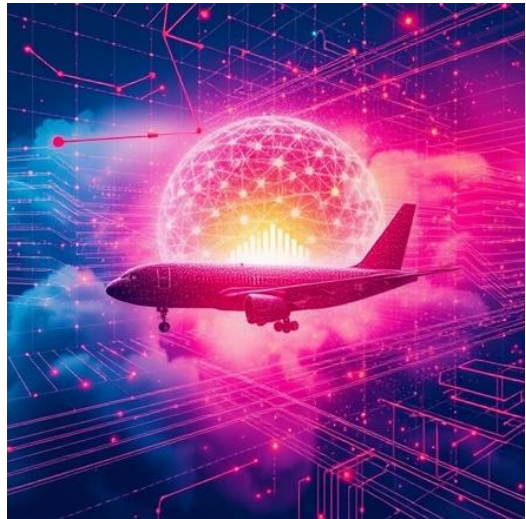




AI in Noise Research: An Exploratory Think Piece

How Could Artificial Intelligence Be Used as an Effective Tool to Assist in Noise Research

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Introduction

Some people might call me old school, but I've always tried to keep up with the times. Lately, I've been wondering how innovation can actually help me in my work. One word keeps popping up: "AI." It's become a bit of a buzzword, and as someone who's been researching noise for over 35 years, I started thinking, "How could AI be useful in my line of work?"

I'm not an expert in AI—far from it. In fact, I knew next to nothing about it before starting this think piece. So, I decided to dig into it a little more: What is AI? What does it do? What tools are out there? How could it be used in noise research? And where does it go too far? That is, where do we risk misusing it or over-relying on it? My goal is to figure out how AI can legitimately advance scientific research on noise, specifically in my area of aircraft noise.

¹ Generated from deepai.org

For this article, I have unashamedly used AI to assist with research and to help assimilate my thoughts. I make no apologies for this, as it proved to be quite beneficial. It served as an intriguing experiment to discover capabilities and functionalities (and limitations). However, in this article I do not advocate for any particular AI proprietary applications as (1) this is not intended as a review of these, and (2) these tools need to serve a purpose, and this will vary between person and their specific objectives, and (3) this is a rapidly developing field and many may be out-of-date by the time you read this article! Some reference is made to some of the proprietary AI tools by way of example only, but please note that there are many similar examples that could also be available. It's a fast-evolving field, and new tools are being introduced regularly (even since starting this piece, Deepseek has become live) so this is a 'snapshot' at the time of writing.

Some of you might already be familiar with AI, but there might be others, like me, who are curious and want to demystify the AI "unicorn" in the world of scientific research. Maybe you even have examples—good or bad—that we can all learn from.

This think piece is meant to prompt, or maybe continue, a conversation. Keep in mind, I'm not a computer scientist, coder, or AI expert. I'm just someone who wants to learn more and see how this tech might help in my day-to-day work. So, let's start with the basics....

What do laypeople think AI is?

To answer this, I conducted a small, informal survey among friends, family, and colleagues from various backgrounds. The responses were quite diverse, reflecting a range of understanding and misconceptions.

Some laypeople view AI as a futuristic, almost magical technology capable of doing anything and everything—a common sentiment fuelled by science fiction movies and media portrayals. Others have a more pragmatic view, recognizing AI in everyday applications like virtual assistants (e.g., Siri, Alexa), recommendations on streaming platforms, and customer service chatbots. A very small number had looked into AI in more detail. A few even expressed concerns about AI taking over jobs or infringing on privacy. Interestingly, while some people were enthusiastic about the potential benefits of AI, others were wary, perceiving it as an unknown that could disrupt their daily lives or pose ethical dilemmas. This mix of excitement and apprehension underscores the need for clear, accurate information about what AI is and how it functions, as well as its limitations.

So what is AI?

I started by asking an AI tool to explain AI to a novice:

"AI, or artificial intelligence, is essentially technology that allows machines to think or act in ways that seem intelligent, like a human might. It's designed to perform tasks

that typically require human intelligence, such as understanding language, recognizing images, making decisions, or solving problems”.

In a nutshell, AI is centered on machine learning, which involves computer programs that can "learn" and "adapt" using the information provided to them. A helpful analogy is imagining a robot being taught to perform tasks by showing it examples; the robot learns from these examples and is then able to make decisions independently.

I have established that AI uses a number of main steps. I used a couple of AI tools to generate the following image to show the main stages:



Data: AI is fed lots of data (like pictures, text, or numbers). This data is used to teach the AI how to recognize patterns.



Algorithms: These are step-by-step instructions that the AI follows to make sense of the data. The AI uses these algorithms to process the information and learn from it.



Training: During training, the AI is shown examples (e.g., lots of pictures of cats and dogs). It "learns" what makes a cat different from a dog by analyzing the data.



Prediction or Decision: Once trained, the AI can make decisions or predictions based on new information. For example, it can look at a new picture and say, "That's a cat!"



Feedback and Improvement: AI improves over time. The more data and feedback it gets, the better and more accurate it becomes.

In short: AI learns from examples, finds patterns, and uses that knowledge to make decisions or predictions.

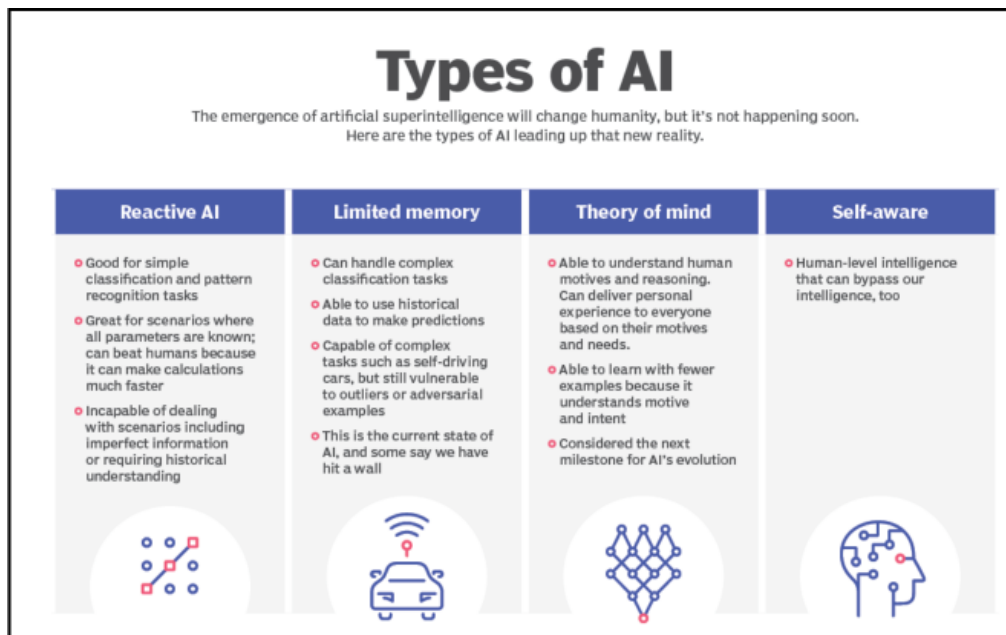
What are the classification types of AI?

There are a number of types of AI that I have found. One classification uses capabilities to define the types:

1. Artificial Narrow Intelligence (ANI) – also known as weak AI. This is the kind of AI we see most often. It's good at specific tasks, like facial recognition in your phone, recommending shows on Netflix, or helping a GPS find the fastest route and to navigate (e.g. Tesla self-drive). It includes virtual assistants like Alexa, Google Assistant, Siri. Other applications include spam filters, and language translation such as Google Translate. However, it can't do anything beyond the task it was designed for.
2. Artificial General Intelligence (AGI) - also known as Strong AI. This seems to be considered as a theoretical form of AI that can understand, learn, and apply knowledge across a wide range of tasks, similar to human intelligence. It is suggested that we don't have this kind of AI yet, but it's a certainly a goal for the future.

3. Artificial Superintelligence (ASI): This is definitely hypothetical at present, an AI that surpasses human intelligence in all aspects, including creativity, problem-solving, and emotional intelligence - I am now having flashbacks of the film 'I, Robot'.....

AI can also be classified based on according to functionalities as below.



2

Self-aware AI is the final stage of AI development, where the AI has its own consciousness and self-awareness. This type is purely theoretical at this point - more flashbacks of I, Robot...

What is the difference between AI and machine learning?

I frequently notice these terms being used interchangeably or alongside one another. These terms are indeed closely related but are actually distinct concepts;

Artificial Intelligence (AI) is the broader concept - the big idea of making machines smart, so they can do things that normally require human intelligence, like decision-making or problem-solving, where as,

Machine Learning (ML) is a specific part or subset of AI that teaches machines to learn from data, so they can get better at tasks over time without being directly programmed. So rather than being explicitly programmed to perform a task, ML

² <https://www.techtarget.com/searchenterpriseai/tip/4-main-types-of-AI-explained>

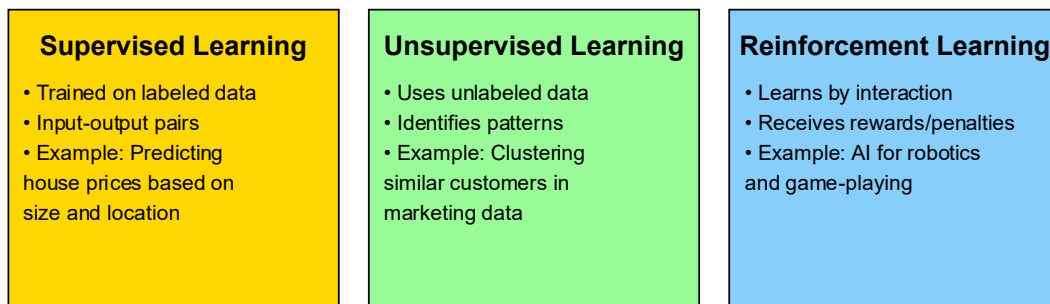
systems identify patterns of large datasets and improve their performance over time. It learns from data and make decisions or predictions without being explicitly programmed for every task.

So, AI can be considered as the broad concept, and ML is one way to achieve it. Or put another way AI is the big picture, and ML is a key method for building intelligent systems.

How does a machine learn?

Machine learning algorithms use large amounts of data to identify patterns and make predictions or decisions based on that data. There are different types of learning (see below) and as more data becomes available, machine learning models can adjust and improve their accuracy and performance.

Types of Machine Learning



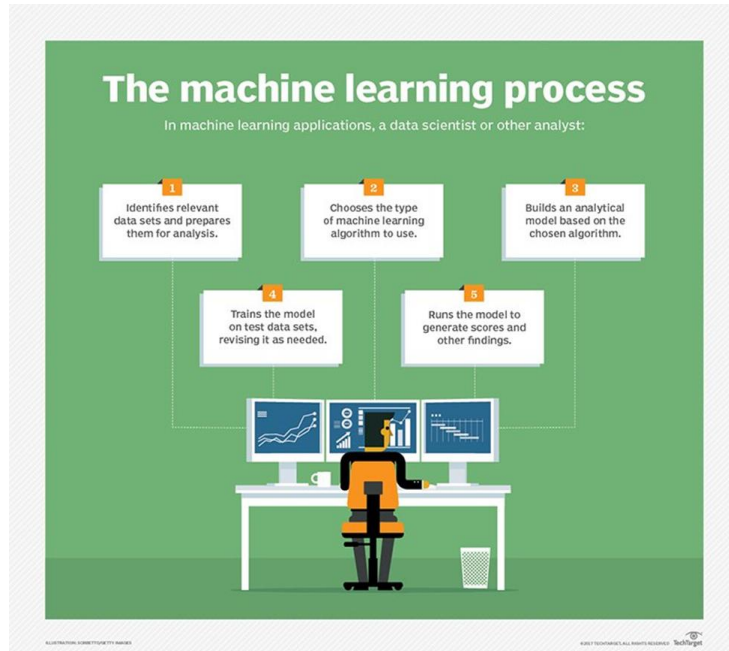
3

Essentially in supervised learning, the algorithm learns from labelled (classified) data to make predictions (mainly using regression), whereas unsupervised learning uses algorithms to find patterns in unlabelled data, clustering groups similar data points together without prior training. Reinforcement learning adopts through trial and error with rewards/penalties and is not directly related to regression or clustering. So, machine learning essentially needs far less instruction! But I am sure there must be risks associated with this!⁴

³ Generated using Chat GPT, Claude, and edited

⁴ Semi-supervised learning is another one of the most used types of machine learning technique that uses a small amount of labeled data and a larger amount of unlabeled data. The labeled data helps the model learn to make predictions, while the unlabeled data helps in improving the model's accuracy by providing additional information about the structure of the data

The general process is described below:



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So how might AI assist (or destroy) my role?

We have so far looked at the general features of AI and next I want to move to how it could assist in my role as a scientific researcher, specialising in environmental noise research.

Chat GBT puts it simply that:

“AI is a tool that makes machines smarter, allowing them to assist us with everyday tasks, and in some cases, help solve complex problems that humans would struggle with alone”.

AI might be very useful for scientific research through its ability to handle large amounts of data or complex calculations faster and more accurately than humans. It can help analyse data, predict outcomes, or identify patterns that researchers might miss.

However, could I be out of a job? Could I be replaced by a robot? I would like to think it should help me do my job more efficiently and effectively by using it as a tool rather than eliminate my role! Hopefully AI could transform my job and not eliminate it by taking over repetitive tasks, allowing me to focus on the more complex and creative aspects of my work. It might even enhance my productivity and efficiency, as well as develop my skills.

⁵ <https://bitstechnology.org/2018/12/14/introduction-to-machine-learning-and-deep-learning/>

Next, I want to explore what types of AI tools exist, and specifically how these could potentially be used effectively in noise research.

What type of AI tools exist?

I used 'AI' to generate the following table which shows the main types of AI tools, many of which could potentially assist with my noise research role.

Types of AI Tools and their purpose

1. **Learning Tools** – to help computers learn from data.
2. **Language Tools** – to understand and generate human language.
3. **Image and Video Tools** – to analyze and understand images and videos.
4. **Speech Tools** – to convert spoken words to text and vice versa.
5. **Chatbot Tools** – to create conversational agents to interact with users.
6. **Data Analysis Tools** – to analyze and visualize data for insights.
7. **Automation Tools** – to automate repetitive tasks in businesses.
8. **Cloud AI Services** – to provide AI tools and services through the cloud.
9. **Ethics and Fairness Tool** - to ensure AI models are fair and unbiased.

My main experience as a novice before this exploration had been using ChatGBT which is primarily classified as a (2) Language Tool. Its purpose is defined as to understand and generate human language. ChatGPT is an advanced AI tool designed for language understanding and generation, making it a valuable resource for communication and information retrieval. In fact, ChatGBT tells me that it:

- Engages in conversations, answering questions and providing information.
- Generates text-based content, such as articles, stories, and summaries.
- Can assist with language translation, text editing, and summarization.

Its underlying technology is based around (1) Machine Learning built on advanced machine learning techniques, specifically using a model called GPT, and (Generative Pre-trained Transformer) and (2) Natural Language Processing (NLP) to understand context, grammar, and the nuances of human language, enabling it to generate coherent and contextually relevant responses.

There are currently a number of natural language processing (NLP) AI tools, similar to ChatGPT, each with its own features and capabilities. These tools use AI to facilitate effective communication and streamline the process of retrieving and sharing information. The following presents a table giving examples of other AI tools that might be considered as valuable resources for communication and information retrieval – however it should be noted that this is a fast-changing field, and these are all being continually developed, updated, renamed and additional tools are being introduced all the time. For example, Deepseek has now become live even since I first prepared this table!

AI Tool	Developer	Key Features
Google Gemini	Google	Problem-solving, multimodal capabilities
Claude	Anthropic	Human-like interactions, extensive context window
Microsoft Copilot	Microsoft	Integrated into Microsoft products, content creation, productivity tasks
Bing Chat	Microsoft	Combines search engine with chatbot, up-to-date information
ChatSonic	Writesonic	Generates up-to-date and accurate responses, including images
OpenAI Playground	OpenAI	Customization and experimentation with different AI models

However, there are many other types of AI applications/tools that could potentially assist with my research work which I will now explore in this article.

What are the key research activities that might be facilitated by the use of AI?

To start I decided to list some of the key activities of my research work. My next task was to both explore, and to try and use, some of the available AI tools which might assist with some of these tasks. The following sections therefore cover the following topics which collate together some of my main work duties.

- 1 Research planning and idea generation
- 2 Data collection and analysis
- 3 Evaluation, assessment, and prediction modelling
- 4 Communication and presentation of ideas – including creative content and media generation
- 5 Ensuring ethical practices and quality assurance
- 6 Project management

Taking each in turn.

1 Research planning and idea generation



Can AI tools help with literature reviews?

Definitely.

AI tools are reported as transforming the literature review process, providing and quickly analyse extensive datasets, pinpointing key studies and crucial information with accuracy and speed. It has been suggested that by simplifying the research workflow, AI-driven literature review tools might be able to save time, enabling researchers to concentrate on analysis and interpretation.

My initial concerns when I considered this type of AI tool were the possibility of bias, the range of tools and knowing which might be best for my work, plagiarism, poor synthesis, misinterpretation, inadequate searches (limited to x number of papers), over-reliance on review material rather than use of primary research papers, and lack of focus around key questions.

AI literature review tools offer a wide range of functions and capabilities designed to streamline and enhance the research process. Here are some of the key features:

In my exploration of the tools on offer, I found that they seem to fall into the following broad categories based around increasing functionality and capabilities:

1. **Collation and Organisational tools:** Finding and organizing relevant articles and papers to support literature reviews. It does this through key word searches to find literature and contextual searches to find papers related to specific questions. Some of the tools offer the capability to screens paper for relevance based on predefined criteria and duplication detection.

2. **Summary tools:** Condense documents into concise overviews, highlighting key points for quick comprehension. It does this by either automatically summarising text, highlighting key points and findings, or through extracting abstracts and key sections to provide quick overviews.
3. **Review tools:** Offer in-depth analyses and critiques of existing literature to enhance comprehensive reviews. This primarily involves identifying and extracting key themes and concepts from the literature. Some have meta-analysis capabilities such as combining results from multiple studies and identifying trends and patterns over time. Some of the tools have the capability to assess the quality and reliability of the studies included in the review, and to identify potential biases in the literature. Some also offer a range of visual representations such as maps and graphs showing relationships or connections between papers and themes.
4. **Consensus tools:** Answering a specific question and providing source material as evidence base. These tools help researchers synthesize evidence from multiple studies, providing a clearer picture of the consensus on specific scientific questions. It essentially works by analyzing large datasets of research papers to identify emerging trends and gaps in the literature. It can also use sentiment or tone of the literature to understand the general consensus.
5. **Writing Support:** Offer drafting and editing assistance to enhance the quality, coherence and clarity of written work. It is based around drafting literature review sections by integrating the summarized content. It can also organize and format references and citations.

As we progress from steps 1 to 5, it seems to me that the tools increasingly assume the responsibilities of my specialist role.

During the development of this article, I tried a number of these tools out with varying degrees of success. As a starting point, I picked my specialist topic of aircraft noise, annoyance, health and quality of life. I even used my own papers as ‘seed’ sources to see what came up. It was illuminating but I am not going to recreate my findings here, I would encourage the reader to try themselves and evaluate the outcomes and develop their own preferences for tools for their own specific purposes – horses for courses!

It is worth commenting that some of the available tools offer free versions, others have pay plans. Some are limited to discovery, not analysis and can be limited by their databases. Many do not actually produce the review but the material for a review (often with summaries – yay, still have a job!). Some do attempt to answer specific questions using the review material (e.g consensus tools). The level of comprehensibility depends on the key questions, specific instructions, and the size of the database it draws from, among other factors.

I concluded that there are challenges to relying completing on AI literature review tools which must be borne in mind when using these, including:

1. **Incompleteness:** AI tools may not cover all relevant literature, leading to incomplete analyses.

2. **Complex Queries:** They can struggle with complex or nuanced queries, limiting their effectiveness in diverse research contexts.
3. **Usability Issues:** Some tools have a steep learning curve and may not align well with user requirements, hindering widespread adoption.
4. **Bias and Accuracy:** AI models can introduce biases based on the data they were trained on, potentially affecting the accuracy and objectivity of the reviews.
5. **Integration Challenges:** Integrating advanced AI solutions can be a challenge.
6. **Transparency and Reproducibility:** The results generated by AI tools can sometimes lack transparency and reproducibility, making it difficult to verify findings.

In conclusion, some limitations of AI tools for literature review include potential biases in AI algorithms, the need for human oversight to ensure accuracy, and the possibility of missing nuanced information that requires expert interpretation.

Can AI tools help with brainstorming ideas and mind mapping?

Yes. AI can be like a brainstorming buddy—suggesting ideas, organizing thoughts, filling knowledge gaps, and refining your research questions. I discovered that the tools can help with the following stages of brainstorming research ideas:

HOW CAN AI TOOLS ASSIST WITH BRAINSTORMING?

Use	Description
Get Topic Ideas	AI tools can suggest research topics based on your field of interest.
Focus or Broaden Ideas	AI can help make broad ideas more specific or suggest different angles on a narrow topic.
Spot Gaps in Research	AI tools can summarize existing studies and point out unexplored areas.
Combine Different Fields	AI can suggest ways to mix two fields to create interdisciplinary research ideas.
Find Keywords and Background Info	AI can suggest search terms and summarize basic information.
Formulate Research Questions	AI can help turn your topic into specific questions or hypotheses.
Summarize Complex Topics	AI can break down information into simpler summaries.
Visualize Ideas	AI mind-mapping tools let you organize ideas visually.
Access Current Trends	AI tools that pull real-time data can help brainstorm new, relevant, or trending topics.
Get Early Feedback	Some AI can give feedback on your ideas, highlighting strengths and areas for improvement.

In short, several AI tools are great for brainstorming because they help generate ideas, refine concepts, and inspire creativity across various domains.

I tested this process out using my topic area of aircraft noise and quality of life research. I used some of the tools to identify areas of research that are key to aircraft noise and quality of life, to identify key gaps and then to ask how AI might help address these gaps. I then used

other tools to present the various conclusions in slides – box 1 shows the outcome reduced to four slides.



Aircraft Noise Research and Quality of Life

KEY AREAS, GAPS IN KNOWLEDGE AND HOW AI MIGHT HELP

Main Points



Community Noise Annoyance
Community noise annoyance is a major concern in the field of aircraft noise and quality of life. It can lead to sleep disturbance, stress, and other negative health outcomes.

Speech Interference
Speech interference is another important issue related to aircraft noise and quality of life. It can cause difficulty in communication and can lead to social isolation and reduced quality of life.

Children's Learning
Aircraft noise can also have a significant impact on children's learning. It can lead to decreased cognitive performance, impaired reading ability, and other negative effects.

Community Well-being
Community well-being is also an important aspect of research in the field of aircraft noise and quality of life. It involves the assessment of overall community health and quality of life in areas affected by aircraft noise.

Conclusion

Key gaps in research
Despite progress made in research on aircraft noise and quality of life, key gaps still need to be addressed, including non-acoustic factors, bias and accuracy, integration challenges, and community engagement.

AI for noise mitigation
AI can help identify hidden patterns, develop metrics, predictive models, mitigation strategies, and economic analysis for aircraft noise and its impacts.





How AI Can Help

Identifying Hidden Patterns
AI can identify hidden patterns in aircraft noise data that humans may not be able to see, helping researchers gain new insights into noise pollution and its effects on quality of life.

Predictive Models
AI can help develop predictive models that can estimate future noise pollution levels and their impact on people's lives. This can help researchers develop effective mitigation strategies.

Mitigation Strategies
AI can help develop effective mitigation strategies that can reduce noise pollution and its impact on people's lives, such as by optimizing aircraft flight paths or developing noise-reducing technologies.

Box 1: Illustrative example of initial brainstorming

I am not presenting the above as a 'fait accompli', far from it. The output above was just myself and my laptop (brainstorming on own using my 'AI brainstorming buddies') – it is just an illustration that took less than 15 minutes to generate. It is as good/bad as the questions, source material (it only used 4 references), clarity and detail of my instructions etc. The output lacks depth, explanation, context etc I would probably only give it a C+ at best.

However, the output could be used to start a team brainstorm or feedback session or develop a more in-depth AI (or non-AI) generation of ideas.

AI in team brainstorming can be a useful tool, i.e. using AI as your team's helpful assistant - there to support good ideas (but not create them all). Quick tools that could be used:

1. NLP tools as an extra team member to bounce ideas off.
2. Summary tools to turns your team's talking into text automatically.
3. Visual tools to quickly makes your ideas into visuals.
4. Digital whiteboard where everyone can add ideas at once.

However, you need to consider how best to use these, maybe have someone manage the AI tools while others think and talk, use AI to suggest new angles when you get stuck, use of AI auto-recording to catch all the good ideas, and create quick visuals to help explain complex thoughts. I would also suggest that you should keep it simple - AI should help, not take over, maybe have regular tools (like actual sticky notes) as backup, don't waste time waiting for AI - keep the conversation flowing and most of all - focus on human ideas first, use AI to expand them.

Keep in mind the limitations; technically it can be fiddly to set up (and costly), it can kill natural conversation and can't 'read a room', it doesn't understand team dynamics or company specific situations. AI is a helper, a tool and not the main show so it should not be over-relied on, and the focus should be on real people talking to each other.

One tool I use on a regular basis in my work is mind mapping - a visual tool for organizing and representing information. It helps me map out my thoughts and ideas in a graphical form. It involves creating a diagram with branches that link related thoughts around a central concept. It helps me by breaking down complex topics into smaller, more manageable parts, making it easier to understand and remember information. This in turn helps me to plan reports and communicate complex concepts (yes - I did mind map this article when I was planning its content, and without AI). Mind mapping could also be used as a brainstorming tool. There are a number of robust mind-mapping tools with templates and AI-based organization and task automation. They offer AI-based formatting, and a range of visual layouts and generally purport to support brainstorming, note-taking, and structured organization of ideas to represent the flow of ideas.

Can AI tools assist with developing methodologies?

AI can help you design research methods by making the planning easier and more reliable. It is suggested that it can help as follows, but I haven't tested out the depth of claimed abilities on each task:

HOW CAN AI TOOLS ASSIST WITH DEVELOPING RESEARCH METHODOLOGIES?

Task	Description
Find Out What Others Have Done	AI can quickly show you common methods used in similar studies, so you can see what's worked well before.
Suggest Research Designs	Based on your goals, AI can suggest ways to set up your study, like using surveys, interviews, or experiments.
Help Formulate Hypotheses	AI can turn your big questions into specific, testable ideas and help you figure out what you need to measure.
Choose Data Collection Methods	AI can recommend the best ways to gather data, whether through interviews, surveys, or observations.
Select Participants	It can also suggest how to choose a good sample of people for your study, making sure it's fair and relevant.
Create Survey Questions	AI can help write clear, unbiased questions for surveys or interviews, making it easier to collect useful answers.
Pick the Right Analysis Tools	AI can suggest which analysis methods will work best, so you know how to interpret your data once it's collected.
Automate Parts of the Process	For data-heavy projects, AI can help with data collection and analysis, saving you time.
Ensure Ethical Practices	AI can point out ethical issues, like privacy and consent, so your study respects participants' rights.
Review and Refine	After you draft your plan, AI can give feedback, helping you spot weaknesses before you start.

In short, AI tools purports to have the ability to help guide you through the whole process of setting up your research, making sure it's thorough, ethical, and efficient. However, it should not be used to design the whole research process! There are limits and drawbacks:

Limits and Drawbacks to using AI to design research methodology

Aspect	Details
Understanding Complexity	AI may not fully grasp complicated research questions that need human insight.
Context Awareness	AI can miss important social or cultural factors that affect research.
Data Quality	If the data used is biased or incomplete, the research design can be flawed.
Ethics	AI might overlook important ethical issues like participant consent and privacy.
Analysis Limitations	While AI can analyze data, it may struggle to interpret the results meaningfully without human input.
Rigidity	AI tools can be inflexible and may not adapt well to new information or unexpected challenges.
Need for Human Insight	Good research often needs creativity and collaboration that AI can't replicate.
Cost and Access	AI tools can be expensive and may require specialized knowledge, which not all researchers have.
Technical Issues	AI can make mistakes or misinterpret data, leading to poor research decisions.
Overreliance	There's a risk that researchers might depend too much on AI, neglecting essential traditional skills.

In summary, while AI can help in designing research, it's important to use it alongside human judgment and expertise.

2 Data collection and analysis



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Can AI tools support data collection?

AI tools can significantly enhance data collection in both laboratory and field research, especially when dealing with exposure and response data.

I started researching this issue by asking my 'AI buddy' a question:

⁷ Another example of AI* generated sketch (p.s. I'm not that young!)

Q: “if I want to do a noise survey and understand demographics around an airport and collect quality of life information for those living in vicinity, how could use AI tools help me with this data collection task (not the analysis of this data)”

After several iterations, the outcomes are summarised below:

A: ‘AI can definitely streamline and improve data collection for a noise and quality of life survey around an airport. Here’s how AI tools can help you during the data collection phase itself.....

Task	AI options
1. Survey Design and Optimization	
	AI Survey Tools: Some platforms like SurveyMonkey Genius or Typeform’s AI can suggest optimized survey questions based on your goals, ensuring questions are clear and unbiased. They can even help tailor questions for different demographics, which can make data more relevant and detailed.
	Adaptive Questioning: Some AI-driven survey tools can adjust questions in real-time based on previous responses, ensuring you capture the most relevant data for each respondent without overloading them.
2. Smartphone and Sensor Data Collection	
	Noise Monitoring Apps with AI: Apps like SoundPrint and Decibel X use AI to measure and record noise levels from smartphones with decent accuracy. They can aggregate data and even adjust for different phone microphone sensitivities. You could use these apps to encourage residents to capture noise data directly, giving a firsthand look at noise levels in specific areas.
	Wearable Devices: If you want continuous or more precise data, AI-enabled wearable devices like Nokia’s SmartWear can capture noise and environmental data (like air quality) in real time. These tools can automatically log data and link it to specific locations
3. Data Quality Control	
	AI for Detecting Data Anomalies: AI tools can automatically flag incomplete or low-quality responses. For example, Qualtrics and other survey platforms have built-in AI that detects if participants are rushing, answering inconsistently, or giving poor-quality responses.
	Voice Recognition: If you collect audio responses, voice-to-text tools like Google Speech-to-Text or Otter.ai can transcribe responses accurately, allowing you to collect spoken feedback quickly and store it as text.

Task	AI options
4. Geolocation and Demographic Data Integration	
	AI-Enhanced Geolocation: AI-powered GIS (Geographic Information System) tools like Esri ArcGIS can help tag survey responses with precise geolocation data. By using location tracking with consent, these tools can automatically record where data was collected, linking noise and quality of life responses to specific areas.
	Data Enrichment: You can use AI to pull in additional demographic data (like census data) relevant to respondents’ locations. This data enrichment can automatically add details like average household income or population density, providing more context for each response.
5. Mobile and Web Survey Optimization	
	AI Chatbots for Surveys: Chatbots powered by AI, like SurveyBot or Survey Sparrow, can conduct surveys interactively. These bots can ask questions and respond conversationally, increasing engagement and response rates. They can be deployed over messaging apps, making surveys more accessible and engaging for users.
	Multi-language Support: If you have a multilingual population, tools like Google Translate API or Microsoft Translator Text API can help translate your survey automatically, broadening accessibility.
6. Incentivizing and Tracking Responses	
	AI-Powered Gamification: AI-driven platforms like Pollfish can create engaging surveys with rewards, or make the survey feel like a game, increasing completion rates. AI can suggest incentives based on respondent behavior, making it easier to motivate participation.
	Automated Reminders and Follow-ups: Tools like HubSpot’s AI-powered CRM can help you send personalized reminders to participants who haven’t completed the survey. This can increase response rates by reminding people at optimal times.

⁸ Other proprietary AI tools available!

.....using AI for data collection, you could create smarter surveys, track location and demographic data automatically, check data quality, and engage respondents more effectively. AI tools for survey optimization, noise monitoring, automated follow-ups, and multilingual support would all help ensure you collect high-quality, comprehensive data”.

AI tools can potentially automate data collection, saving time and effort. They use natural language processing to analyse text data from sources like academic papers, social media, and news articles. They can also analyse images and videos, helping researchers gather diverse data. By automating the process, AI tools might be able to improve data accuracy by eliminating errors like duplicates and irrelevant information, ensuring high-quality data.

However, a word of warning – integrating these tools can be challenging due to potential model uncertainties, black-box algorithms, and the risk of deskilling professionals.

Can AI tools help with data analysis?

Yes, AI can help with analysing data. I focussed on how the tools could potentially predict how people react to airport noise by finding patterns, predicting factors, analysing sentiments, and recommending solutions. The following summarises what I found out, and although I am not advocating for any particular AI app, I thought it may be useful here to provide a simple rundown of AI tools you could use to analyse people’s reactions to airport noise to indicate the claimed general capabilities.

HOW CAN AI TOOLS ASSIST WITH DATA ANALYSIS?

EXAMPLES FOR TRYING OUT CAPABILITIES

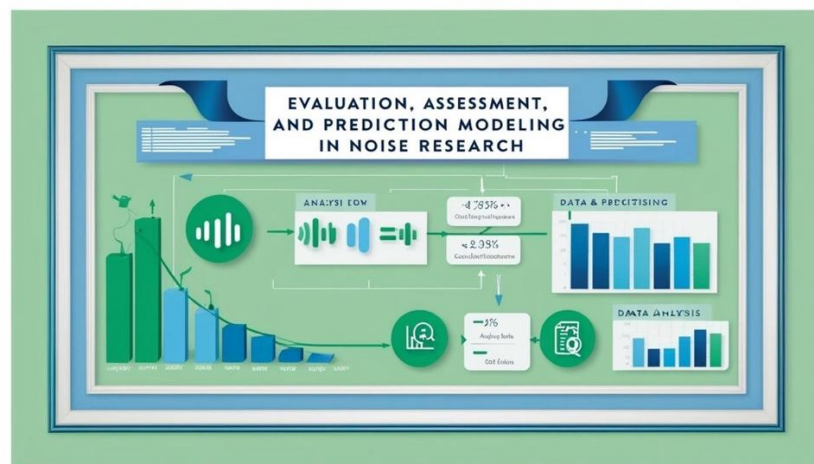
Category	Description
Data Analysis and Pattern Detection	AI can analyze demographic data, noise levels, and reported annoyance to find patterns, such as certain age groups or proximity to the airport correlating with higher annoyance.
Predictive Modeling	AI can predict which types of people are more likely to be annoyed by airport noise using supervised learning models trained on factors like noise levels, distance from the airport, and demographics.
Sentiment and Trend Analysis	AI can analyze qualitative data, like survey comments, to detect sentiment trends (positive, negative, neutral) using natural language processing tools.
Recommendations for Action	Based on patterns and predictions, AI can suggest actions to reduce annoyance, such as where to place sound barriers or modify flight paths.

Category	Tools	Description
Easy-to-Use Platforms	Google AutoML, Microsoft Azure ML, IBM Watson	Beginner-friendly tools that can spot patterns, make predictions, and analyze survey responses without needing much technical skill
Mapping and Visualization	Tableau, QGIS	Tools that can create maps and visual charts to show areas where people are more annoyed by the noise
Text Analysis for Survey Responses	Google Natural Language API, Hugging Face	Tools that can analyze written survey responses to see if people are feeling positive, negative, or neutral about the noise
AutoML Tools for Fast Insights	DataRobot, H2O.ai AutoML	Mostly no-code tools that can analyze data and make predictions quickly without needing programming skills

In addition to enhancing data accuracy, AI tools purport to facilitate real-time data collection and reporting, allowing researchers to quickly identify trends and respond accordingly. For

example, AI-driven sentiment analysis can potentially provide instant feedback on public opinion regarding noise levels, maybe leading to enabling timely interventions and policy adjustments. Moreover, AI tools, when used well, can manage large datasets more efficiently than traditional methods, reducing the burden on researchers and allowing them to focus on more complex analytical tasks.

3 Evaluation, assessment, and prediction modelling



AI tools have the ability to provide substantial support for evaluation, assessment, and prediction modelling in noise research. Using advanced algorithms and machine learning techniques, these tools have the potential to analyse vast amounts of data and identify patterns that might not be immediately apparent to human researchers. Noise monitoring equipment now has the ability for noise source detection using machine learning and sophisticated data analysis techniques to precisely identify and classify diverse noise sources within urban landscapes.

Through predictive modelling, AI has the ability to forecast future noise levels, and their potential impacts based on historical and real-time data. One interesting and relatively early article I looked at related to machine learning to effectively predict workplace noise. In this study AI helped identify high-risk noise zones, and developed a model to proactively notify workers before dangerous noise levels occur.⁹

These tools can therefore be used to assess the effectiveness of noise mitigation measures by comparing pre- and post-intervention data, thus offering insights into which strategies are most efficient. AI's ability to process and analyze complex datasets quickly and accurately might ensure that researchers can make informed decisions and refine their approaches to noise management.

⁹ Wen, P.-J., & Huang, C. (2020). *Noise Prediction Using Machine Learning with Measurements Analysis*. *Applied Sciences*, 10(18), 6619. <https://doi.org/10.3390/app10186619>

Moreover, AI powered tools might help to evaluate the socioeconomic and health impacts of noise pollution by integrating data from various sources, such as demographic information, health records, and environmental sensors. This holistic approach would enable a comprehensive assessment of the noise environment and its implications.

So, the practical applications of AI in this context are vast. Tools like machine learning algorithms can predict future noise impacts based on current data, while advanced statistical models can assess the effectiveness of mitigation measures. Furthermore, AI can assist in visualizing data through interactive dashboards, making it easier for stakeholders to understand and act on the findings.

Furthermore, AI is playing an increasingly important role in soundscape research, helping researchers and urban planners better understand, analyse, and design acoustic environments. AI can assist with source recognition, monitoring, mapping, design and simulation. AI has the potential to assist with soundscape-based noise mitigation through dynamic noise control systems that respond to changing environmental conditions for example, where AI tools predict when and where noise pollution will peak and automatically adjusts urban design elements (e.g., shifting traffic flow, modifying sound barriers). I can direct you to a key paper¹⁰ that really explores how AI could revolutionise the field of acoustics, which takes this initial think piece beyond my research role to the next level. The paper suggests that AI is transforming acoustics by optimising room acoustics, noise control, environmental monitoring, speech processing, and healthcare applications. Its integration into soundscape design enables quieter, healthier, and adaptive environments. The paper underscores AI's role in shaping sustainable, human-centred acoustics, enhancing urban soundscapes and quality of life.

¹⁰ **Starowicz, A., & Zieliński, M. (2024).** *Sustainable Acoustics: The Impact of AI on Acoustics Design and Noise Management*. Technical Sciences, 27, 193–209. DOI: [10.31648/ts.10297](https://doi.org/10.31648/ts.10297)

4 Effective communication and clear presentation of ideas - supporting creative content and media generation



AI tools can really help improve communication and presentation of ideas using various advanced technologies. I've been working in this area for some time without AI. At Anderson Acoustics we adopted techniques as using animations, for which we received encouraging feedback.¹¹

It looks like AI could be a useful tool here in this journey for more effective communication. For example, AI-powered presentation software can help create visually appealing and coherent slides by suggesting layouts, colour schemes, and even how to organize the content based on the topic and audience. Tools like natural language generation (NLG) can automatically summarize complex data into concise, easy-to-understand narratives, making it simpler to convey important insights without overwhelming the audience. Additionally, AI can provide real-time language translation and transcription, breaking down language barriers and making sure presentations are accessible to a global audience. Furthermore, AI can analyse audience engagement and feedback through sentiment analysis. These tools not only enhance the clarity and impact of presentations but also make the preparation process easier, letting presenters focus more on the substance of their message rather than the mechanics of presentation creation.

AI tools are revolutionizing creative content and media generation. Using advanced algorithms, these tools can create high-quality content, whether written, visual, or audio. For instance, AI platforms can generate music, images, videos, and even articles or scripts. By analyzing large datasets, AI tools can mimic human creators' styles and produce up-to-date content. They offer suggestions, spark ideas with multiple options, and assist in editing.

¹¹ <https://andersonacoustics.co.uk/news/aviation-noise-management-research-post-covid-ii/> - also found in <https://www.ioa.org.uk/news/acoustics-bulletin-july-august-2021-issue-available-members>

Integrating AI allows content creators to focus on bigger research content and ideas while tech handles repetitive tasks, refines details, and explores new possibilities.

A quick note on the images generated for this article – I have tried to play with some freely available AI image generation tools, and there was certainly a learning curve ('Nicole learning' not 'machine learning'). There are many style/image/colour options available. The output is not only dependent on the tool but in a much larger way the details in the prompt that you give it. Some images work better than others!

5 Ensuring ethical practices and quality assurance



AI tools can be beneficial in maintaining ethical standards and ensuring quality in noise research. By utilizing machine learning algorithms and advanced data analysis, AI assists researchers in adhering to ethical guidelines and enhancing the quality of their work.

One way AI can support ethical practices is by automating the anonymization of data. In noise research, it is important to protect sensitive information about participants, such as their location or identity. AI can efficiently anonymize this data, ensuring personal privacy while still allowing the use of necessary information for research.

AI can also aid in monitoring compliance with research protocols and ethical standards. By continuously analyzing data collection and processing methods, AI systems can identify any deviations from established protocols and flag potential ethical issues. This proactive approach helps maintain the integrity of the research process and ensures alignment with ethical guidelines.

Quality assurance in noise research is also improved by AI. Advanced AI-powered tools can validate and cross-check data rigorously, ensuring the accuracy and reliability of the collected data. These tools can detect anomalies, inconsistencies, and errors, allowing researchers to correct them before they affect the study's outcomes.

Additionally, AI can potentially assist in peer review and collaboration by offering objective assessments of research quality. Machine learning algorithms can evaluate the strength of research methods, the validity of results, and the overall quality of the research output. This helps uphold high standards and ensures that only thoroughly vetted research is published and shared within the scientific community.

In noise research, AI tools can also aid in designing and executing research more effectively. By simulating various scenarios and predicting potential outcomes, AI can help researchers create better and more ethical studies. This not only improves the quality of the research but also reduces the risk of harm to participants and the environment.

In summary, integrating AI into noise research can potentially provide a robust framework for maintaining ethical practices and ensuring high-quality results. Through data anonymization, compliance monitoring, rigorous validation, and optimized experimental design, AI tools might enable researchers to conduct their studies with integrity and excellence.

Integrity and honesty are crucial in our profession. We must be transparent about the application of AI tools. Such disclosure fosters trust and adheres to professional and ethical standards.

6 Project management



AI tools bring a lot of benefits to managing noise research projects. They help make the whole process smoother, more accurate, and better coordinated among team members. For example, AI project management software can handle routine tasks like scheduling, assigning resources, and keeping track of progress automatically. This frees up project managers to focus on more important decisions. AI can also predict possible delays using past data and the current status, helping you stay on track.

Additionally, AI can improve collaboration and information sharing. With real-time updates and smart data integration, everyone on the team stays informed and aligned on goals and progress. AI tools can also provide insights into team performance and project health, making

it easier to spot and fix problems early. When it comes to resources, AI optimizes their use by analyzing project needs and what's available. This ensures resources are used efficiently, reducing waste and boosting productivity. AI can also monitor budgets in real-time, helping to avoid overspending.

AI is able to enhance data management by quickly and accurately organizing and analyzing large amounts of research data. This saves time and improves the reliability of the data for making decisions. AI is useful for managing risks too. It can evaluate different risk factors and their potential impact, helping you create strategies to deal with them ahead of time. This is especially useful in noise research, where unexpected issues can significantly affect results.

Moreover, AI tools can help summarize project meetings. They can transcribe meeting conversations in real-time and generate concise summaries, highlighting key points, decisions made, and action items. This ensures everyone is on the same page and helps to keep the project moving forward efficiently. Having tested this ability, I would suggest it may be good as a first draft, but work is required to make it nuanced and accurate.

AI tools are also useful for looking up what has already been done or said about a topic or task. They can search through vast amounts of data quickly, pulling out relevant information from previous research, reports, and discussions. This makes it easier to build on existing knowledge and avoid duplicating efforts. Another word of caution though, if entering your working notes or thoughts into a company-based platform, be aware AI searches can extract that information for other company members.

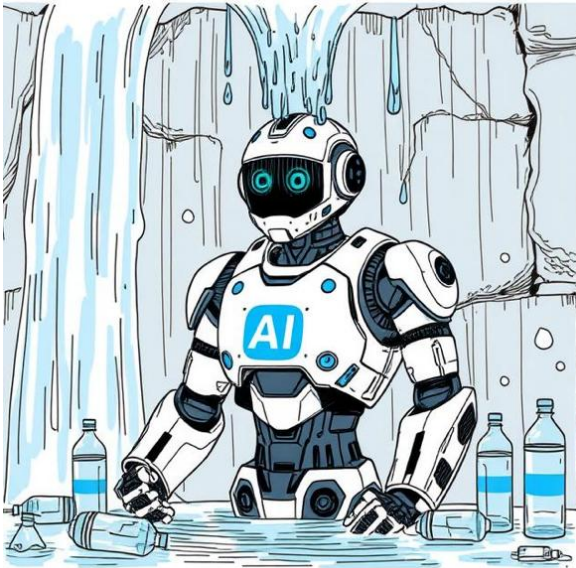
In short, using AI tools in noise research project management makes everything more efficient, collaborative, and well-organized. These tools help project managers handle complex projects with greater precision and success. I would recommend that a company strategy and protocol is developed within the company, with education and awareness being key to any successful implementation.

Downsides



While AI tools offer numerous advantages, they are not without their downsides and limitations. One significant concern is the ownership and protection of information. When using AI platforms like co-pilot or chatbots, sensitive data could be at risk of exposure or misuse. Ensuring robust data security measures is paramount to prevent potential breaches. Compliance with regulations such as GDPR (General Data Protection Regulation) is crucial to safeguard personal data and protect users' privacy rights.

Another issue is sustainability. AI systems require substantial computational power, leading to increased energy consumption and environmental impact. For example, the water consumption of AI models like ChatGPT comes primarily from data centre cooling and electricity generation. Estimates suggest that training large AI models (like GPT-4) can use millions of litres of water, while daily operations also consume significant amounts:



Training a single large AI model (e.g., GPT-3) is estimated to use around 700,000 litres of water.

A ChatGPT interaction can use 500 ml to 1 litre of water, depending on energy sources and cooling efficiency.

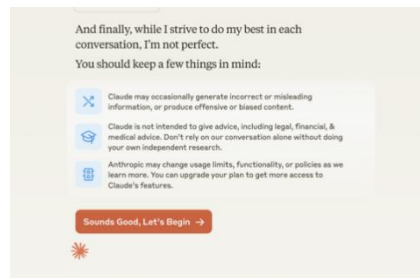
This raises questions about the long-term viability of relying heavily on AI for managing noise research projects. To mitigate the environmental footprint of AI technologies, it is important to consider using energy-efficient hardware and renewable energy sources. Some Gen-Z 's I have talked to, opt to use alternatives to asking ChatGBT queries for this very reason, preferring to do their own searches.

Accuracy and reliability of AI-generated insights are also a concern. Despite advancements, AI systems can still produce errors, particularly when coding for macros or performing complex data analyses. These errors can propagate through the project, leading to faulty conclusions or misguided decisions. Regular verification and oversight remain necessary to maintain the integrity of AI applications.

There may also a challenge to our integrity – as professionals we should be transparent about how we have used the AI tools. Disclosure builds trust and aligns with professional and ethical standards.

These downsides underline the importance of a cautious and well-considered approach to integrating AI tools into noise research projects. While AI can significantly enhance productivity and efficiency, mindful implementation and vigilant oversight are crucial to mitigate potential risks.

At least some of the AI tools strive to be honest!



CONCLUSIONS

AI has the potential to transform noise research by making it more efficient, accurate, and comprehensive. However, it is important to use AI alongside human judgment and expertise to ensure the reliability and validity of research findings.

So how can one manage expectations of AI now and in the future? Managing AI expectations requires understanding its current abilities and future potential. Today, AI excels at specific tasks like image recognition and language translation but isn't capable of human-like general intelligence. I think the key is to be transparent and educate yourself and others about AI's strengths and limitations. AI systems need lots of data and training, and they can make mistakes or be biased, so it's important to critically evaluate their outputs. For the future, it's important to stay informed about AI advancements and be cautious – we must discuss the ethical and societal impacts of AI to ensure its responsible use.

Given the significant potential of AI to enhance productivity and efficiency, as well as the inherent challenges and risks associated with its implementation, is it time to consider recruiting AI specialists into our companies? These experts might be able to help optimize the use of AI tools while ensuring that any issues are effectively addressed. The development of a company-wide AI strategy and education is also a necessity.

We need to ensure the balancing of enthusiasm with informed cynicism, so we can utilize AI effectively while being aware of its challenges. Maybe before using AI we should ask **'Just because we can, does that mean we should?'**