The Realities of Generative AI in the Print Industry Today

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If you ask about the origins of artificial intelligence (AI), you are likely to hear that it was "invented" in the 1950s by Alan Turing1 of the eponymous "Turing Test"2 of a machine's ability to think, or John McCarthy3, who is credited with coining the term "artificial intelligence" and developed the LISP programming language. However, there are many others who contemplated the possibility of machines that could think long before we had machines that could compute. In fact, "A Complete History of Artificial Intelligence"4 documents contributions to the field of artificial intelligence beginning in the Late Classical Period (380-323 BC) of human history. So why has a concept that has been deliberated for millennia and put into practice over several decades seemingly taken over the public consciousness? It seems to be the addition of the word generative to the mix.

The goal of this whitepaper is to provide printing executives with an understanding of how generative AI differs from previous approaches and how it can be applied to the print industry, while also being mindful of related business risks. This whitepaper has been sponsored by Canon Solutions America (Canon) to raise awareness of the changing business climate but does not contain references to Canon products or services.

The Difference a Word Makes

All AI systems use large amounts of data and machine learning algorithms to achieve the goals for which they were designed. To date, most systems have been designed with the goal of improving data analysis by recognizing patterns and making predictions. Generative AI systems based on Large Language Models (LLMs) are able to take a leap beyond traditional AI by applying natural language learning models, ingesting massive amounts of data and recognizing patterns in the data to actually create new content such as text, images, audio, video and more based on human prompts.

Generative AI systems rely on foundation models5 of data as a base to learn the inherent patterns and structure of the systems they intend to emulate. As of the time of publication, the most widely known of these systems is ChatGPT from Open AI. The scope, and accuracy, of the content that can be generated by an AI system is limited by the foundation model on which it has been trained. For example, if you query Chat GPT about its foundation model, it will provide the following caveat:

"As an AI language model, my responses are generated based on a mixture of licensed data, data created by human trainers, and publicly available data. I have not been directly trained on specific data sources, such as websites, databases, or proprietary information. The publicly available data used to train the foundation model of ChatGPT includes information up until September 2021. This means that my knowledge and understanding are based on events, data, and information that occurred prior to that date. It's important to note that I don't have access to real-time data sources and cannot provide information on events or developments that have occurred after my knowledge cutoff. Thus, for the most current and up-to-date information, it's always advisable to refer to reliable sources or news outlets."

Despite its wide recognition, ChatGPT is only one of the many generative AI solutions on the market with many more in development. According to research from CB Insights6, generative AI companies have already received $14.1B in equity funding in 2023, including $10B to OpenAI alone. Their Generative AI Market Map7 identified over 300 generative AI startups across 50 different application categories as diverse as gaming, protein design, patent generation and architecture. There are also a number of companies with solutions that offer real-world, practical application to the printing industry.

Practical Applications of Generative AI in the Print Industry

Generative AI can be used today to enhance employee experience as well as customer satisfaction, but don't expect to replace your workforce with robots just yet. At this stage, the technology is best suited to enhancing human productivity rather than replacing jobs in any significant number. Consider the path of the Interactive Voice Response (IVR) systems a few decades ago. These systems helped to direct calls to the proper place more quickly but did not replace call centers. After coming into widespread use, they did replace the position of telephone receptionist at most companies.

Like the IVR, generative AI can also streamline customer service through highly interactive, next-level chatbot applications that can be text-based or voice-based. Tools can generate natural language responses to assist with customer questions and even answer in a natural sounding voice. In fact, tools from companies like Resemble.ai8 and ElevenLabs Inc.9 can clone a person's voice, add emotional inflection, and translate responses into multiple languages. While this technology is likely to take mundane inquiries out of the call queue and route customers more quickly to the correct subject matter expert, it is not likely to replace that subject matter expert in the near future.

Generative AI can also be used to help make subject matter experts within your organization more productive. Consider some of the everyday work that can be enhanced with generative AI tools for designers, marketers, and software engineers.

Creative Teams

AI can help designers focus on their creative skills and remove time-consuming administrative and technical tasks. For instance, AI tools can:

- Upscale low-resolution images, removing artifacts and improving image quality.
- Remove backgrounds from photographic images.
- Create multiple, iterative arrangements of text and graphic for rapid prototyping.
- Conduct automated checks to ensure design consistency, accessibility, and adherence to brand or other standa
- Track and update expired content such as logos, licensed content, or based on campaign parameters.

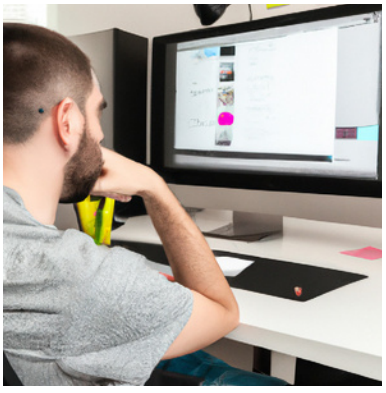
AI tools like Midjourney10, Stable Diffusion, and Open AI's DALL-E can also generate wholesale content such as line drawings, graphics and even photos on design parameters. Creative teams can leverage tools like Pictory, Synthesys, and Synthesia to streamline video editing, create subtitles, generate music tracks, sound effects, or voice dubbing.

CREATIVE TEAMS AND CONTENT GENERATION

Using tools to generate new content requires the user to define a query that specifies the type, subject and format of the content with enough detail to guide results. The content might be a photo, line drawing or other type of digital art. The system will provide multiple responses which can be further edited and refined. Generative AI can also extrapolate new images from existing ones, such as generating a new photo based on a person's face or placing an image of a product in a new location or combining components from various images in a "mix and match" campaign.

Query

Photo of a brown-haired man 30 years old using design software on a computer


Source: Elizabeth Gooding and DALL-E

Query

Black female dog with white tipped tail wearing a crown sitting on a green throne

Source: Elizabeth Gooding and DALL-E

Query

Painting of a lion drinking coffee in a cafe in Marseille in the style of Klimt

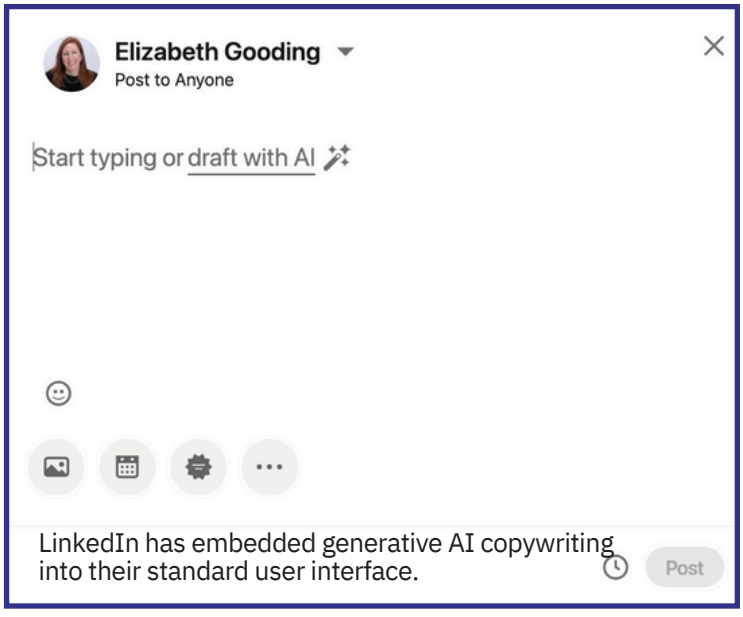
Source: Elizabeth Gooding and DALL-E

Marketing Teams

Beyond the potential for visual media generation, AI has tremendous potential to improve efficiency for marketers from strategy through execution. Consider the potential for your company, your customer's marketing team and the impact on how you can work together more effectively supported by generative AI solutions. For instance, you and your customers can:

- Analyze vast amounts of customer and prospect data, including social media and other online content to derive valuable insights about target audiences, market trends and consumer preferences.
- Help focus marketing on the most lucrative segments by detecting patterns in customer data and defining characteristics to support effective targeting of marketing content. These capabilities also help to prioritize high-quality inbound leads (lead scoring) and tailor relevant lead-activation campaigns.
- Evaluate competitors' brand messaging, advertising, online content, and market data to identify gaps and opportunities.
- Generate concepts for direct marketing or statement marketing messages including drafting compelling copy with variations to address different target segments.
- Spawn tailored marketing messages, product recommendations or offers for individual customers or customer segments based on customer data, behavioral indicators, or defined rules.
- Automate A/B testing by generating different variations of headlines, copy, visuals or offers, and testing against different customer or prospect segments.
- Streamline the generation, posting and tracking of social media content.
- Translate individual items of content into multi-channel campaigns by adapting to different lengths and formats and recommending visuals.
- Translating content into multiple languages is also an emerging capability – but localization, cultural adaptation and appropriate tone are not fully robust.

Similar to the outlook for creative professionals, generative AI can automate or streamline many of the more mundane administrative functions for marketers. It can also help marketers to keep an eye on market shifts, emerging trends and get ahead of potential customer churn. In some cases, this does not even require an investment in new technology. Many widely used marketing tools like HubSpot, LinkedIn and SalesForce are adding generative AI capabilities to their systems to help marketers draft content more quickly, understand optimal posting times and analyze social media trends from within their platforms.



LinkedIn has embedded generative AI copywriting into their standard user interface.

Software Engineers and Other System Developers

Code generators are not a new thing. Well before the introduction of AI to the mix, there have been tools to automate development tasks. Any non-programmer who has taken advantage of a "build your own website" tool has experienced a level of code automation. While the list of generative AI tools aimed at developers is growing rapidly, none have reached the capability to generate consistently correct code, a fact that companies like OpenAI are proactively transparent about. They recommend not using any code that has been automatically generated before a qualified human has reviewed it. Similar to applications in design and marketing, the tools can save time in developing "first drafts" of code according to guidelines set by a programmer. Conversely, there are tools that will offer suggestions to improve code developed by a human coder in real time, auto complete repetitive segments of code or provide helpful references on Application Programming Interfaces (APIs). They may also be used to more quickly clone and repurpose existing code for new customer on-boarding scenarios where a significant portion of the technical process is repetitive across customers. A programmer will still need to review and finalize the code, but with the proper prompts it can fill in many of the necessary variables and prompts throughout the program.

However, there is more to coding than code and this is where generative AI tools can boost programmer productivity by automating repetitive tasks such as:

- Generating test data
- Automating unit testing
- Troubleshooting code errors
- Drafting documentation

As tools mature, and development teams gain experience working with them, there will be further efficiency gains. Generative AI tools are designed to learn from developers by processing feedback and ingesting code samples that reflect corporate standards. For now, don't expect it to run AI-generated code without reviewing, testing and debugging and asking your development team if the code that has been generated will be efficient to maintain.

Something for Everyone – Especially Printers

While many generative AI tools are intended for a particular task or type of user, there are aspects that can be used by anyone. Like the AI "bots" intended to make customer service faster and more efficient, internally directed tools can help organize emails, maintain calendars, and even draft correspondence and reports. These tools are being built into the productivity suites used in corporate offices every day to help make information easier to find, summarize reports and detect patterns in data and define escalation workflows to alert the appropriate individual when needed.

Workflow automation is an area of keen interest for printing companies and one where past iterations of AI technology have already made inroads by analyzing production data and operating costs to identify inefficiencies or proactively schedule maintenance. In an inkjet environment, AI tools have been used to anticipate printhead failures and optimize quality. Generative AI tools are emerging that will be able to streamline the automation process by allowing tasks and goals to be described in natural language and

letting the tool generate a workflow template. The process of defining current state and desired state workflows is incredibly time consuming for printing organizations and generative AI has the potential to dramatically reduce the time to delivery of proposed workflow upgrades while laying the groundwork for continuous improvement.

Another highly valuable application of generative AI is to production printing environments test data creation. The value of test data for programming staff was noted earlier but the application to printing companies extends far beyond the IT department. Everyone from transaction printing companies to direct mailers struggles to attain adequate test data to mirror all the use cases that a particular applica- tion is intended to support. Many companies fall back on running real end-customer data through test environments. In addition to being risky, there is no guarantee that all the potential scenarios exist in any batch of data. AI tools provide the opportunity to use live data as the training model while eliminating any personally identifiable information from specified generation scenarios. The resulting data sets can be used for system testing at the printing company and their customer's IT operation, by marketing to look at all combinations of variable data and content, and for customer acceptance testing on new systems as well as regression testing of any changes. As data drives more print applications, better test data becomes increasingly important to efficient operations and more collaborative customer relationships.

Balancing Risk and Opportunity

There are tremendous opportunities to make work more efficient for many professionals using generative AI but there are also perceptual, technical, and legal risks. From a legal perspective, technology development and adoption has dramatically outpaced relevant legal and regulatory standards. Here are just a few key issues that could impact creators of AI tools and their customers:

- Photo and graphic library services, as well as individual content creators, are suing AI image generation platforn for using their content as part of the data used to train their systems without permission or compensation.
- Open-source software tools are making similar claims against code generation tools that were trained on open-source code, but do not market their products according to open-source licensing agreements.
- News outlets have also raised legal arguments against the use of their content to train text generation tools.
- Finally, there is the question of whether AI-generated content of any type can be copyright protected. A recent copyright submission for images generated using AI tool Midjourney included in a graphic novel was rejected by the U.S. Copyright Office11 stating that "...the images in the Work that were generated by the Midjourney technology are not the product of human authorship. "

Lawmakers around the world also have to grapple with issues concerning who is liable for the creation or publication of inaccurate, harmful or defamatory content. While this is an issue of global concern, it is also an immediate internal concern for any company using AI to generate content for customer service or any other publicly consumed purpose. Like many automation solutions, the output from generative AI is only as accurate and appropriate as the foundation model, training algorithms and human prompts used to generate it. While the opportunities are attractive, corporate leadership should expect to invest time learning about how introducing these tools can impact operational and risk management processes.

Proceed With Caution

As companies are deciding when and how they want to take advantage of generative AI solutions, they may find that their employees have already started using various tools on their own. OpenAI reported that ChatGPT had acquired 1 million users within five days of its launch. By June 2023, Similarweb data12 showed that the platform had 1.6 billion visits during the month with an average duration of over seven minutes. Chances are good that there are some emails, reports and other content being drafted using a generative AI tool at your organization. Corporate leadership must put guidelines in place, even before formal adoption of any tools. Here are some thoughts on where to start:

Guidance Create policies for the use of free, web-based generative AI applications in the workplace. If use of tools is allowed, the policy may require generated text-based content be reviewed and approved by an internal subject matter expert prior to use, ensuring that all facts referenced are verified and sources citations located. A more conservative approach may ban the use of any AI tools that have not been explicitly approved for use by the corporation.

Communication As tools are approved to enter the work environment, communicate with employees about the intended use and any impact on job descriptions, responsibilities, approval workflow. Employees may be concerned about having their jobs made redundant.

Training Adapting to an AI supported environment requires a two-pronged approach to acquire expertise with the selected tools while providing opportunities to upskill or retrain portions of the workforce effected by automation. Education should begin in advance of technology adoption. This scenario should be familiar to printing companies who have undertaken other types of workflow automation.

Application

Start slowly by using generative AI tools for tasks short of creating final content. For example, expediting research, idea generation, summarizing internally generated data, automating repetitive design tasks, auto-filling templates for technical specifications, generating test data and automating internal testing processes. These capabilities can make individuals and teams more effective while falling short of automatically generating any portion of the end product sold to customers.

Data protection Since these tools rely on large datasets for training and ultimately generating output, it is essential to handle all data ethically, ensuring privacy, data protection, fair use, and compliance with relevant regulations. Customers should be informed about opportunities related to data usage (such as test data generation) and have control over how their data is utilized. This protection should extend to the use of visual training on customer's proprietary or licensed imagery and copy.

Pricing Similar to the adoption of inkjet, printing companies prepared for arguments that AI efficiencies should drive price reductions for their customers. Look for ways to focus the discussion on value creation and educate customers on the role that human subject matter experts play in deriving value from AI tools.

Regulation Stay abreast of proposed legislation to govern the use of generative AI solutions, ownership of work product and liability for incorrect or defamatory results. This is a critical time to be following print industry lobbying groups and commenting on proposals that could impact business.

Insurance
Similar to the impact of data privacy regulation over the past decade, AI related regulation will have a domino effect on the cost and availability of insurance coverage.

Contracts
Printing companies should be prepared for customers to push any contractual risk related to the use of generative AI back onto them as the service provider. As these tools are introduced, contracts must be updated, and printing companies will need to be informed and proactive to ensure that their own interests are protected as customers seek to protect themselves from uncertainty.

Experience
Anyone who expects to be in a position to make decisions about the use of generative AI in their company should get hands-on experience and learn the basic terminology necessary to understand the potential benefits as well as the hazards inherent in the technology.

In order to create value, companies must address a range of ethical considerations around transparency, fairness, and accountability with employees and customers. Taking a step-by-step approach to navi- gating the use of generative AI tools responsibly is important to fostering trust and mitigating risk.

As of this writing, the number of generative AI products entering the market is exploding. These products should be viewed as potential tools, but not as solutions that can replace existing personnel. To take advantage of these tools as their robustness and reliability improves, printing companies will need to consider how to best apply them to their specific business and internal skill set.

Generative AI has accelerated more quickly in the past year than previous approaches in previous decades. This whitepaper covers some of the applications most suitable to early adopters but is not intended as an exhaustive list of potential uses. It has many more applications to the print industry that can drive value for companies that have developed policies and infrastructure to mitigate the related business risks.

Endnotes

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