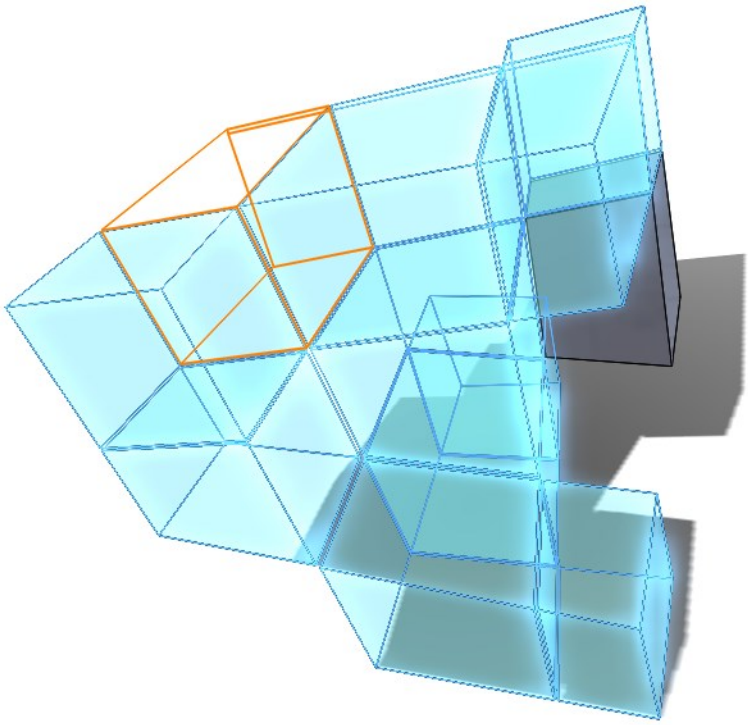

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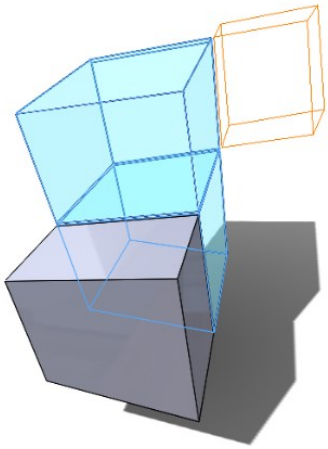
ARTIFICIAL INTELLIGENCE AS A CREATIVITY COMPANION



ARTIFICIAL INTELLIGENCE AS A CREATIVITY COMPANION

by Sandro Zaccolo

Submitted to OCAD University in partial fulfillment of the requirements for the degree of Master of Design in Strategic Foresight and Innovation

Toronto, Ontario, Canada 2020

Abstract:

This body of research explores the alarming decline of human imagination in North America to what many have deemed a creativity crisis. **At age five, children score at a 95% genius creative level. This drastically depletes to 2% by the age of 30, essentially unlearning creativity as they mature.** As one of humanity's most important soft skills, creativity is essential to a nation's well-being and economic growth as we emerge toward a more complex, uncertain future. Methodologies used to explore this problem included a strategic foresight design toolkit along with life centered-design thinking, to unpack, analyze and synthesize gathered information. **Major findings resulted from the understanding of a decline that started in 1990 during which many technological and societal forces were at play including the rise of the internet, the millennial generation living with social media and the growth of artificial intelligence (AI).** Further expert interviews consolidated the idea of AI as a creativity partner rather than a suite of creative tools to automate emerging generative design. While AI evolves to machine learning (ML), key research questions are asked regarding a future when we are saturated with similar forms of ML tools at our disposal. **What will humans rely on next to contribute creatively?** This research proposes design for a computer-human interaction solution in an attempt to reverse the creativity decline and act as the imaginative companion required to foster creative capacities.

Acknowledgements:

Jeremy Bowes, a sincere thank you as my primary advisor. Your patience, enthusiasm and wisdom allowed for an exciting project journey and an important investigation which I intend to continue in a meaningful capacity. The COVID19 pandemic made everything a greater challenge, however, the learning during this research has been a joy. (contact: jbowes@faculty.ocadu.ca)

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To my Ginny, thank you for everything and enabling yet another dream together, my love.

Dedicated to Mom and Dad (*riposa in pace*):

My lifelong creativity companions.

Who encouraged natural play,

curiosity, passionate work,

achieving excellence,

making mistakes,

fearlessly using our hands and minds

to make and dream.

We did it.

Table Of Contents

List of Figures 6
1 SOMETHING IS GOING ON? 9
1.1 Introduction 9
1.2 A Creativity Decline 10
1.3 Creativity and Deeper Questions 13
1.4 Creativity Coaching 19
1.5 Artificial Intelligence & Machine Learning 20
1.6 A Respectful Intervention 22
1.7 Chapter One Summary 24
2 WHAT ARE WE SEEING, HEARING, DOING, FEELING? 24
2.1 Generative Design 24
2.2 AI and Coaching 27
2.3 Computers As Partners in the Creative Process 28
2.4 Creative Landscape Temperature Check 31
2.5 A Kinder-Garden 33
2.6 Emerging Contributions of AI 36
2.7 Chapter Two Summary 40
3 NAVIGATING THE CHAOS 41
3.1 Embrace, Dream -------Do Something. 41
3.2 Opportunity for Change 46
3.3 Learning By Doing 47
3.4 Chapter Three Summary 50
4 A CRY OF JOY 50
4.1 Trust The Process 50
4.2 White Board Work 51
4.3 Deliverable Remap For Children 57
4.4 Sketching Illumination 62
4.5 Out of Our Mind & Off Paper 68
4.6 Yo͞oˈrēkə 70
4.7 Chapter Four Summary 73
5 IT TAKES A VILLAGE 74

5.1 FLOURISHING GARDENS 74
5.2 AI AUGMENTATION 75
5.3 YO͞OˈRĒKƏ STRATEGY 75
5.4 CHAPTER FIVE SUMMARY 77
6 FINAL THOUGHTS 78
REFERENCES 80
APPENDIX 85

LIST OF FIGURES

Note: All images and photos of branded products and technology have been used for the purposes of academic discussion and have been referenced appropriately. (Fair Use/Dealing-Copyright Act USA/Canada) Image sources listed under references on page 83.

Cover and fulfillment page artwork: computer generated, S. Zaccolo…… 1, 2

Fig. 1 Sample of Torrance Test content for assessing creativity…… 13

Fig. 2 Creativity listed as number five as top ten skills required in future…… 14

Fig. 3 Torrance Test data decline data intersecting with generations, internet and social media…… 15

Fig. 4 IDEO innovation framework for innovation consisting of desirability, feasibility and viability…… 16

Fig. 5 Image of IBM's screen interface with Eliza chatbot from 1964-1966…… 21

Fig. 6 Schematic drawing illustrating Turing Test configuration…… 22

Fig. 7 World's first AI produced art portrait of Edmond de Belamy…… 23

Fig. 8 Systemic diagram charting perfectionism…… 24

Fig. 9 World's first AI designed chair for company Kartell in conjunction with industrial designer Philipp Starck…. 26

Fig. 10 Portion of designer Bruce Mau's poster for his incomplete manifesto for growth indicating avoiding software and creativity is not device dependent…… 27

Fig. 11 Flex Foot Cheetah Leg artificial limbs on running athlete by inventor Van Phillips…… 34

Fig. 12 An AI operated robotic hand solving a Rubik's cube, one-handed…… 38

Fig. 13 Timeline image of Boston Dynamics' various AI powered robots from 2005 to 2018..... 39

Fig. 14 Pepper robot..... 39

Fig. 15 Sophia robot at CES 2019..... 39

Fig. 16 Little Sophia robot..... 39

Fig. 17 World's first social robot JIBO, various views..... 40

Fig. 18 Amazon's Alexa and Echo items..... 40

Fig. 19 Mindbloom app screen..... 40

Fig. 20 Rocky AI coaching chatbot..... 40

Fig. 21 Speculative Everything Futures Cone..... 42

Fig. 22 Voroscope Futures Cone..... 42

Fig. 23 Revised, amalgamated Futures Cone combining Fig. 21 and Fig. 22..... 43

Fig. 24 Causal Layered Analysis framework model indicting seven layers..... 44

Fig. 25 2x2 scenario set for first two trends..... 45

Fig. 26 2X2 scenario set for second two trends..... 45

Fig. 27 AI and Mindfulness 2x2 scenario set as product benchmarking..... 46

Fig. 28 2X2 scenario set with first two trends and Lubart's creativity partners..... 55

Fig. 29 2X2 scenario set with second two trends and Lubart's creativity partners..... 56

Fig. 30 AI and Mindfulness 2x2 scenario set evolved per Creativity Partners for Children..... 59

Fig. 31 Small Doses and Data Control 2x2 scenario set evolved per Creativity Partners for children..... 60

Fig. 32 Developed CLA framework model indicating creativity dystopian decline and utopian new future..... 61

Fig. 33 "What IF" pre-sketching primer questions chart in for of Question Storming exercise..... 63

Fig. 34 Consumer market examples of wake-up lights in bedroom context..... 64

Fig. 35 Helm personal internet home server device views in context, security key and as standalone unit.... 65

Fig. 36 Initial ideation sketching sample exploring for a possible Creativity Companion physical unit (children's model)..... 66

Fig. 37 Initial ideation sketching continued sample exploring for a possible Creativity Companion physical unit inspired by preposterous, responsible dreaming (children's model)…… 67

Fig. 38 Various 3D CAD geometry model views of preliminary design for 3D printed models: (from top left: front/three-quarter/top-collapsed/top-articulated/side-articulated)…….. 68

Fig. 39 3D printed sketch models in relation and in context with existing wake-up light…….. 69

Fig. 40 3D printed models along with found objects to simulate possible VR goggles and ceiling projection peripherals…….. 69

Fig. 41 Study model with smart phone and simulated smart watch charging and synchronizing with AI via Bluetooth and/or Wi-Fi for older child context ages 14+…… …… 69

Fig. 42 Various in context bedside views with configurations of different peripherals including VR goggles, ceiling projector, smartphone and smartwatch…….. 70

Fig. 43 Yooreke device design proposing features and operation as AI learning for creative learner….. 72

Fig. 44 Yooreke System configuration indicating main actors and components…….. 73

Fig. 45 Leonardo Da Vinci sketch of mechanical gears as an exploded view…….. 79

1 SOMETHING IS GOING ON?

1.1 INTRODUCTION

This research project began with personal observations from the last 14 years as a design instructor, morphed into a realization and ends with a confession. Only in this introduction will I speak from personal experience as a brief autoethnographic contribution, the remainder of this project follows careful (and messy) design research methodologies guided by a foresight strategy tool chest and design thinking.

There was a real design buzz happening in North America while I was in design college in the early 1990s. It was pre-internet for the most part as most could not afford the computers we now slip into our pockets. We laboured through magazines cutting out intriguing images and articles to build wall collages, listened to alternative music on a radio feeding us creative new material and immersed ourselves into art and events happening in downtown Toronto. Good design required inspiration, perspiration and incubation to produce something special. After 20 plus years in the design industry, I began to notice the buzz numbing to a gentle hum. My career began with designing toys, sports equipment and consumer products leading to polytechnic teaching, running a product business and immersed with every piece of creative work I could fit into my waking hours. Today, my teaching colleagues and I observe students' swipe-skimming through images with minimal reading, sprinkling patience, and sketching with little effort, which, much to our dismay, lacks the dreaming and energy that once was. We have asked ourselves if this might be a societal, generational thing? Perhaps, a parenting trend? Our specific design program or institution? The standardized testing pressure we see in schools known as "exam hell"? Hindering types of technology? Or all of the above? Essentially, we have been witnessing a genuine lack of creativity in the air. My realization: It's not only around us here in Canada, but in the United States also, and their news channels are calling it a "Creativity Crisis" which began in 1990 and is spiraling downward. My confession: recently, during a creativity hiatus due to significant family-life issues, I fell into the trap--------- believing I could maintain creativity by simply only ***thinking creatively***, privately, without producing anything and merely swiping through others' passion, effort and patience on the internet, it was unsuccessful. I did however, experience just how it becomes increasingly difficult to foster, maintain, and evolve creativity capabilities under life's pressures. As I continue to reflect on this research, I believe our creative forces rely on our heads, hearts, and hands working harmoniously together. The question is how will future generations fare?

In Nicholas Carr's book, "The Shallows–What the Internet Is Doing to Our Brains", Carr writes that the internet seems to be chipping away at our capacity for concentration and contemplation, **whether online or not,** our minds expect to take in information the way the internet distributes it: in a swiftly moving stream of particles. "Once I was a scuba diver in a sea of words, now I zip along the surface like a guy on a Jet Ski"–Nicholas Carr. (Carr, 2008)

1.2 A CREATIVITY DECLINE

Creativity is a complex psychological topic with no clear consensus on how to precisely define it. (*The Components and Psychological Study of Creativity*, n.d.) Some believe there are different components of creativity such as originality and functionality, while others believe there is a layer of knowledge when creativity happens. Experts tend to categorize different types of creativity and personality traits shaping what it takes to be creative.

This major research project (MRP) originally began with questioning the future of design's front-end creativity and imagination (often referred to as d*esign's Fuzzy Front End*). This direction originated from both an interest with creativity and a concern with emerging student designers in programs within Canada and internationally. Initial research contributing to this direction came from three camps:

Inspiration came from Sir Ken Robinson's mantra of "How School Kills Creativity" (the most-watched TEDtalk) and begins to expose very interesting research into creativity and education. Ken challenges the way children are being educated. He champions a radical rethink of school systems, to cultivate creativity and acknowledge multiple types of intelligence.

The second source of insight comes from NASA scientists—Dr. George Land and Dr. Beth Jarman who, in the 1960s conducted research with 1600 children, following them from childhood to adulthood analyzing their creativity and imaginative capacity. They concluded that **we unlearn creativity as creativity peaks at the age of five with children scoring at a 95% or genius level**. **When the same children were ten, only 30% scored in the highly creative range. This number dropped to 12% by age fifteen and just 2% by age thirty-one**. As the children matured, they effectively had the creativity trained out of them. In the words of Dr. Land, "non-creative behavior is learned." (Land & Jarman, 1993) Essentially, there are two key types of thinking concerned with the creative process which are defined as convergent and divergent thinking.

1. **Convergent thinking:** Where we judge ideas, criticize them, refine them, combine them and improve them, all of which happens in your conscious thought.
2. **Divergent thinking:** Where we imagine new ideas, original ones which are different from what has come before but which may be rough to start with, and which happens subconsciously.

Land notes that throughout school, children are taught to try and use both types of thinking **at the same time, which is impossible**. Competing neurons in the brain will be fighting each other, and explains it is as if your mind is having a shouting match with itself or **a person is driving a car with both the brake and accelerator pressed at the same time.** (Land & Jarman, 1993)

A third and more recent discovery comes from Dr. Kyung Hee Kim with her research and publications in her study titled "The Creativity Crisis". Kim's 2016 research indicates North American creativity has **steadily declined since 1990.** This disturbing trend recently came to light through her work as a leading educational psychologist and a recognized expert in creativity assessment. Kim earned her second doctorate in 2004 while studying at the University of Georgia under Paul E. Torrance who is most noted for the development of the Torrance Test of Creative Thinking, which is still used in schools worldwide. The findings led to a near global awakening with the realization of **the importance of creativity to a nation's well-being and economic growth.** She has discussed her research with numerous news outlets, including The Washington Post, U.S. News & World Report, The Wall Street Journal, The Metro World News (England), Super Interessante (Brazil), Periodista La Tercera (Chile), Korrespondent (Ukraine), the Globe and Mail (Canada). According to the expertise of Dr. Kim, creativity is defined as creating something useful, valuable, novel and unique. **Often if the impact is large enough it is referred to as innovation.** In the western world, creativity is generally considered amongst the arts and crafts whereas in the east it is more about science and technology. However, Kim states that creativity is in all fields including business, technology, education and science. Dr. Kim believes almost **everyone is born with creative potential.**

> ***"Torrance Testing****: E. Paul Torrance first published the Torrance Tests of Creative Thinking (TTCT) in 1966. Since that time, the TTCT has been re-normed six times, roughly every ten years, in 1974, 1984, 1990, 1998, 2008, and most recently in 2017. The TTCT battery is composed of a verbal and figural component and is available in two forms, A and B. Each activity is based on research linking the required ability to creativity (Torrance, 1966, 1974).* ***Therefore, the two components, when given as an entire battery, measure several different creative abilities. The verbal and figural tests of the TTCT are not simply measures of the same creative abilities or tendencies expressed in two different modalities****. With both measures, the instructions are designed to motivate the respondents to give unusual, detailed responses.* ***The verbal component consists of five different types of activities:*** *(1) ask-and-guess, (2) product improvement, (3) unusual uses, (4) unusual questions, and (5) just suppose. The stimulus for each task consists of a picture to which individuals respond in writing.* ***The figural component consists of three different activities:*** *(1) picture construction, (2) incomplete figures, and (3) repeated figures (Torrance, 1974, 2001a). All of these activities require respondents to draw additions to shapes and incomplete figures to give meaning to the shapes."* (Torrance Center for Creativity and Talent Development, n.d.)

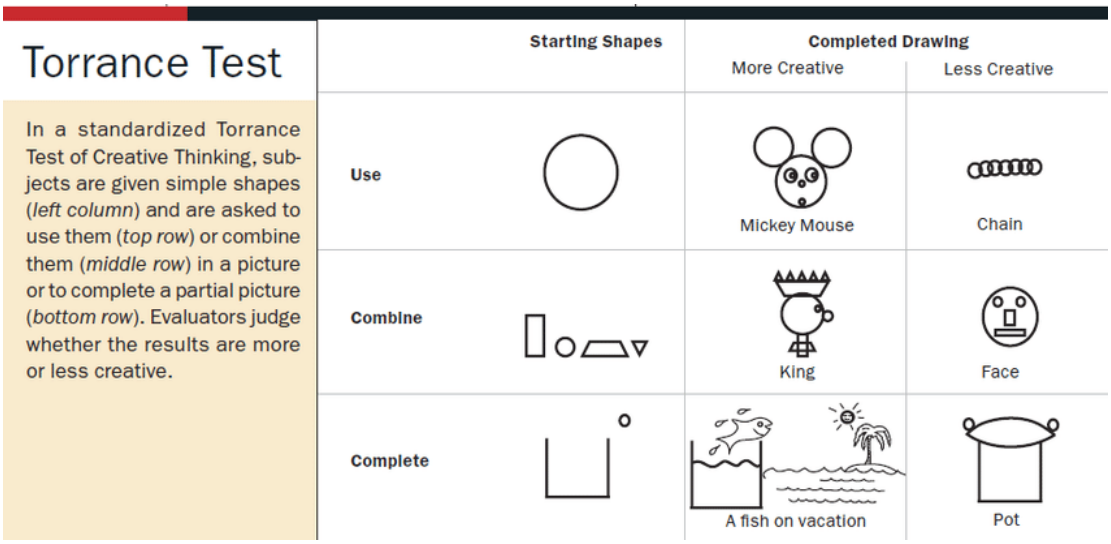


Fig. 1 Sample of Torrance Test content for assessing creativity

Paul Torrance, creativity innovator (1915–2003) Torrance was a creativity and education researcher at the University of Georgia. He spent his career refining a creativity assessment, creating the Future Problem-Solving Program, developing the Incubation Model of Teaching, and spearheading a longitudinal study of creativity. By the time he retired from the University of Georgia, Torrance had established an international reputation as a scholar of creativity with over 1,000 books, articles, chapters, tests, and book reviews, as well as delivering countless speeches and workshops. His namesake tests are still widely used all over the world. **While test validity arguments regarding the Torrance Test do exist**, and could be the basis for an entirely separate research project, it is understood that the research and findings are sufficient and scholarly supported in order to be presented here as a major research problem statement and deemed a wicked, design problem. (*Wicked Problems: Problems Worth Solving - Wicked Problem*, n.d.)

As a secondary attempt to view present day creativity and innovation through another lens, and perhaps more in line with the aforementioned note on creativity being important to a nation's economic growth, one additional research effort was performed to include a reporting update from the **World Intellectual Property Office (WIPO)**. As an annual WIPO statement on intellectual property (IP) indicators, the 2019 reports shares an eye opening indication of a decline of United States (US) patent filings for the first time since the 2009 world economic devastation. (*World Intellectual Property Indicators 2019*, n.d.) **In 2018, the US saw a 1.6% decline in the number of patent applications filed.** (US patent durations typically are granted for a period of 20 years). **Canada saw a 14% decline, meanwhile, patent filings grew by more than 5% worldwide.** Patent filings grew by double digits in China (11.6%), India (7.5%), Korea (2.5%), Singapore and the European Patent Office (4.7%) also saw increases in the number of patent applications filed. Low-and middle-income countries are indicating substantial increases in patent filings: Pakistan (+27.8%), Philippines (+26.7%), Uzbekistan (+17.5%), Morocco (+14.1%) and Vietnam (+12.8%) recorded particularly rapid growth in 2018. ("WIPO Report Validates Fears About U.S. Patent Decline," 2019) Intellectual property is a key component to an

innovation economy and viewed as a metric in this research. This may indicate that the creativity decline since 1990 builds a case where people born in 1985 or later (kindergarten Torrance testers) who are currently 35 plus years old, active in industry careers yet potentially negatively contributing to North American innovation.

1.3 Creativity and Deeper Questions

Creativity will only become more difficult as our world continues to evolve with complex problems future generations will undoubtedly inherit. Creativity is a profound ability to imagine both original ideas or solutions to problems and follow through to contribute positive change. It is through creativity that individuals may have their senses, sensibility and spirit working together. Creativity is a critical skill important as a means to think about and be in our world to live a full life; not only for artists, designers or performers but also for other problem solvers working in health care, law and finance extending to both children and adults making up the fabric of society. Creativity is an ongoing celebration, living and breathing within us which requires constant nurturing, guidance and support, otherwise our creative core lays dormant within us. **While divergent thinking is certainly key to the earlier MRP questioning of design's fuzzy front end, further literature review and reflection pointed to an understanding that all people and professions must be considered in this research work. The World Economic Forum continues to list creativity and innovation as the top five "21st Century Skills" individuals need to thrive in modern society and a define as critical to the future of work.**

Fig. 2 Creativity listed as number five as top ten skills required in future

In Dr. K.H. Kim's book, "The Creativity Challenge-How Can We Recapture American Innovation", research findings are shared along with detailed solutions to help foster creativity to help us be **"resourceful cross-pollinators, curious optimists, resilient hard works and defiant dreamers." These include nurturing early age thinking skills, developing long-term expertise for acquiring knowledge, and grasping many techniques for a creativity filled life.** In fact, there are several hundred such books on creativity, and hundreds more techniques for achieving greater imagination, creativity and innovative thinking. Topping this off is a wide selection of games, sorting cards and the start of low-level creativity applications operating on smartphones which aid in training, gaming and exercising imaginative thought. The questions are: Is this enough? Has it ever been enough or are these old formats of printed and audible instructions not delivering for us anymore? Are there new opportunities to ensure we can support a creativity fueled future as these potentially dated solutions compete with today's online and digital technologies? **Is it coincidental that the creativity drop according to Dr. Kim is in-line with the birth of mainstream internet?** (figure 3.) Have immense advancements in technology and information dumbed us down to a point where surfing for answers is easier and faster? Has all this wonderful technology backfired on us and reversed our progression of creative and innovative thinking? While there is empirical research indicating non-creativity fostering climates in school systems and similar environments within enterprise and a fast-paced society, there is also significant research findings to support that the rise of mainstream internet and social media is greatly contributing to conditions affecting one's creativity development. Conditions which include a mismanagement of technology integrated into daily living as well as high levels of anxiety, distraction and other psychological effects from the internet which is negatively impacting personal environments to foster creativity are at play. (Carr, 2008)

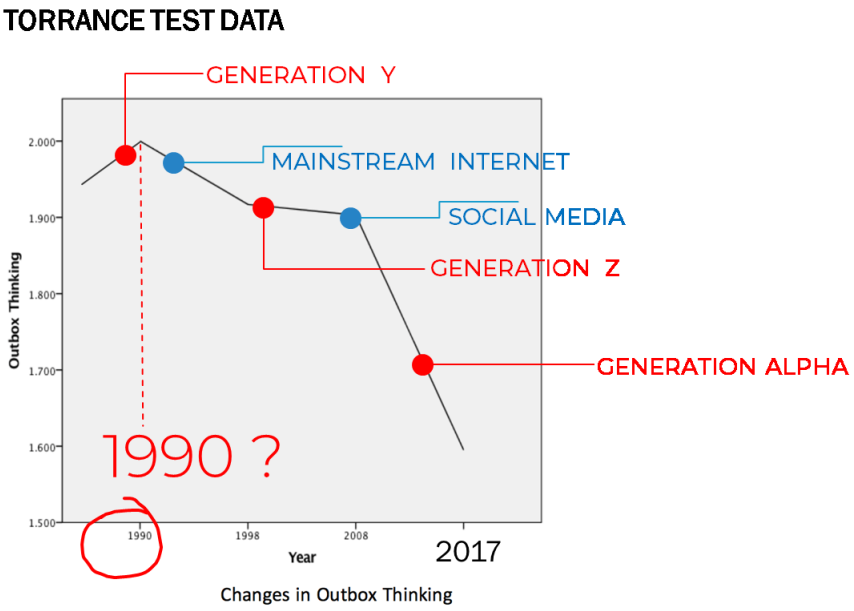


Fig. 3 Torrance Test data decline data intersecting with generations, internet and social media

With such a vast amount of research and resources to foster creativity not only shared by Kim, Land, Jarman and Robinson, but thousands of others prior, how might we **evolve access to support** the regrowth of quality, creative thinking in children and adults? How might we better harness technology to help rather than hinder us? Is there an opportunity to develop solutions which may be feasible, viable and most importantly----------desirable? **Desirable enough, that children will naturally be attracted, and parents pleasantly assured.** Desirable enough that adults today may seamlessly embrace their five-year-old creative self once again? Desirable with enough **high performance** that students, professionals, designers, non-designers, problem solvers and even our older living minds might stop and have a sniff. Could advancements in technology and the super-computing of artificial intelligence assist us? **Alternatively, is this beyond our self-help? Should we seek to train ourselves to be our life-long creativity trainer, or should we look to hire such a trainer as our creativity therapist?** If so, who could that person be and where might we find that special someone who would understand the various ways we think, feel and express. Could they be there for us in a moment's notice during what feels like a eureka moment in the middle of a night's deep sleep? What relief could be possible during a critical head-scratching roadblock in the heart of a project, team meeting, or personal work reflection sitting at one's desk or while driving a vehicle? How might such a support be at our creative beck and call, helping to harness energies, activities and sparks of new illumination? How might we extract some of the wonderful, divergent dreaming and thinking happening in our sleep every night? Lastly, above all, who or what would we trust to enter into our minds' imagination guiding us through one of our most sacred abilities as a human?

Given the need for performance, desirability and robust platform to deliver such a service or product could there be an opportunity for innovation?

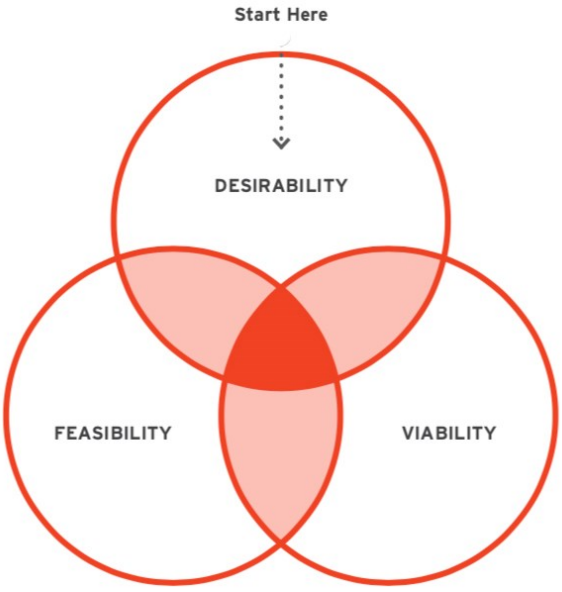


Fig. 4 IDEO innovation framework for innovation consisting of desirability, feasibility and viability.

Loaded with the above queries and insights to frame the challenges associated with fostering creativity, further research was conducted to look at eight trends which may influence the development of **new solutions to create richer learning experiences, enhance creative capacities as a nation and maintain our quality of life as human citizens of the world.**

Entering the trend analysis research, loose research questions (RQ) were formulated in various combinations of how computing technology, algorithms and forms of artificial intelligence aid in creativity, eventually these were refined to a final RQ:

How Might We Embrace Artificial Intelligence and Apply it to Fostering, Personal Human Creativity?

Trend analysis work began with an emphasis to pull from a range direction to gain a comprehensive sense of trend signals, drivers and activity happening in an external environment. Hence, using the **STEEPV** analysis tool to guide information associated with Social factors, Technology, Economic and Environmental factors as well as Political and Value-based factors such as attitudes, lifestyle, privacy and equality.

Listed below is each trend with a brief introductory rationale for bringing its signals and activities into this body of research. **To help guide each trend analysis a key question was formulated as a North Star.** Each of these trends were developed listing trend signals, implications, extrapolations and any counter trends if applicable. Eight trends are introduced below and only those selected to move forward are discussed further in chapter four.

Trend 1 "Body Technology":
Individually, we are a unique type of communicator, learner and thinker. We do this through our combination of audible, tactile, visual, and even spiritual means. With the ever-evolving technology in these areas of interaction, various advanced and evolving forms of human interfacing technologies were explored. **Could there be new forms of interfacing to help with our creativity development?**

Trend 2 "Data Control Matters":
Ideas, thoughts, personal collections of information as one's own data require a safe space. Often, a safe place from society enough to process, incubate and have a chance to become more. Such is the helpful purpose of diaries, notebooks, and collection of information and expressions. A personal space free from outside noise, interaction, social media criticization and other forms of "convergent" thinking influences. **Ultimately, could there be a level of true privacy during our creative dance with imagination?**

Trend 3: "Share Economy":
We are living in a time where there are more answers than questions. There is an abundance of information available where we do not need to begin from scratch every time and may stand to benefit from building upon existing platforms in the way of borrowed templates, algorithms, collection of expertise and tacit knowledge bases. **Is there an opportunity to share, our share of work to help others?**

Trend 4" "At Home With AI":
Artificial Intelligence (AI) and a more evolved version of this technology known as Machine Learning (ML) are beginning to reach a level where it is able to integrate into our daily lives as robust, computing power capable of replicating some human processing and decision making. **With advancements in AI, ML and Creative Intelligence, could it be utilized as guiding powers associated with the complexities of creativity and imagination and work to potentially treat us on a personal, psychotherapeutic level?**

Trend 5: "Mindful Modern Minds":
With life, technology and information moving at ever-increasingly high speeds also brings distraction, noise, and mind clutter as a host of disturbances to focused thinking. Recognizing that divergent thinking, alone, is fundamental to creativity and is best exercised with limited or minimal convergent thinking, a range of trend activity concerning mindfulness, meditation, dreaming and calming the mind in preparation for critical creative thought is explored**. Published research is suggesting that we need to switch OFF from our daily grind and turn ON to connect with our calm and curious selves; how may we facilitate this and experiment with new approaches such as lucid dreaming and hypnosis for creativity?**

Trend 6: "Doing Good":
Our world is broken and steps towards its repair and sustainability are foggy. While there is significant progress in the developed portions of the world, and daily evidence of having built a very lush and comfortable place on the planet for us, fostering creativity for the sake of improving lifestyle experiences, luxurious goods and services are certainly in our fabric, but there are more pressing calls required, and younger generations are concerning themselves to engage with making more of a positive impact on the world than making money. **While it is understood that creativity is important to a nation's well-being and economic growth, could we maintain a steady mission to a sustainable future vision? Could we do this via business enterprise?**

Trend 7: "In Small Doses":
Smaller contributions in many areas of our lives today are, collectively, having a positive impact on ourselves and others. Whether it is in small deposits of time for social media networking or investing amounts of energy toward a cause, societal progress is being made within a fast-paced world. For the most part, w**e are working and living more efficiently than ever before, and this includes our learning, training and overall personal development. Might there be an incremental approach to the development of our creativity over time? If we are too far gone in reigniting our creative core, might there be a respectable intervention?**

Trend 8: "Individualism":
Although working individually has many clear benefits, both for workers and the organizations and clients they serve, collaboration and teams can create superior results. A quest to work independently may seem like a utopian dream but in many cases may cause the opposite dystopian effect whereby individuals are not benefitting from a 1+1=3 scenario in their network. **While creativity does involve focused concentration, time spent alone to reflect, along with other creative rituals exist such as gamification, having fun and engaging with humorous activity------should these activities continue in an individual bubble as much as possible?**

POST TREND ANALYSIS PART ONE:

While researching each of the above trends proved to be a very rewarding learning experience to gaining a deeper influential knowledge base, four key trends areas indicating a generous amount of applicable insight were selected to use in further analysis utilizing foresight tools described more in the following chapters looking at methodologies closer. Residual trend content remained available to inject where applicable to support and further frame the research question and sub-questions. The four trends selected include:

#2-Data Control Matters

#4-At Home With AI

#5-Mindful Modern Minds

#7-In Small Doses.

These four trends are closely incorporated and move forward throughout this research.

1.4 CREATIVITY COACHING

Intrigued by the notion of a professional creativity trainer or therapist (Creativity Coaching) added a new element to this project focus. Research in this area began in concert with the trend analysis work. Discoveries were quickly made and the Creativity Coaching Association (CCA) in the United States was reviewed as a new and unforeseen contribution to this work. As an American psychotherapist, teacher, coach and author, **Eric. Maisel Ph.D. (born 1947)** is the author of more than 40 books and is widely regarded as America's foremost creativity coach. He trains creativity coaches nationally and internationally and provides core trainings for CCA.

"In the early 1990s, while working with creative and performing artists as a psychotherapist, Dr. Maisel developed the coaching specialty of creativity coaching. Creativity coaching focuses on helping creative and performing artists meet their emotional and practical challenges, including overcoming creative blockage and performance anxiety, dealing effectively with the art marketplace, and handling criticism and rejection. Many of the creativity coaches trained by Dr. Maisel have gone on to become certified creativity coaches under the auspices of the Creativity Coaching Association." (Eric Maisel, 2020)

Further exploration of the CCA internet site revealed a comprehensive directory listing of certified coaches around the globe. With detailed profiles available for each, coaching focus was explained as well as individual methods, expertise within a variety of domains to include writers, performers, artists and very key specialization for clients with performance anxiety, self-esteem issues and artists with mental health challenges. With this rich network of like-minded professionals in alignment to this MRP focus it was decided to reach out and establish a plan for expert interviews to be conducted. With five key questions in place, eight coaches in total were contacted from within the US, Canada, Belgium, Italy and the UK. Open ended questions were formulated to allow for open dialogue in a semi-structured approach to gain insight on what is impacting the fostering of creativity and a chance to learn of what barriers and supports currently dominate. Extensive notes were captured and placed on a spreadsheet for analysis and input into the direction of this work. (see appendix A) These outcomes and details are discussed further in chapter two along with literature reviews and additional field experts.

1.5 Artificial Intelligence & Machine Learning

In concert with the trend analysis work, a collection of literature and insights surfaced on artificial intelligence and machine learning with human-like learning abilities as many report to be terrified of due to misconceptions of it outsmarting and potentially overthrowing humanity. While AI and ML are discussed in greater detail in chapter two under AI technology, the fundamentals of AI were researched further while engaging with secondary MRP advisors to begin a dialogue and foundational knowledge. Discussions highlighted interesting early areas of AI with an introduction to the chatterbot Eliza (1964-1966)

"Eliza was an early natural language processing computer program created at the MIT Artificial Intelligence Laboratory by Joseph Weizenbaum. It was designed to demonstrate the superficiality of communication between humans and machines, Eliza simulated conversation by using a "pattern matching" and substitution methodology that gave users an illusion of understanding on the part of the program but had no built-in framework for contextualizing events. Directives on how to interact were provided by "scripts", written originally in a Lispk-like programming language called MAD-Slip, which allowed ELIZA to process user inputs and engage in discourse following the rules and directions of the script. The most famous script, DOCTOR, simulated a Rogerian psychotherapist (in particular, Carl Rogers, who was well-known for simply parroting back at patients what they had just said) and used rules, dictated in the script, to respond with non-directional questions to user inputs. As such, ELIZA was one of the first chatterbots and one of the first programs capable of attempting the ***Turing test****."* (ELIZA, 2020)

Fig. 5 Image of IBM's screen interface with Eliza chatbot from 1964-1966

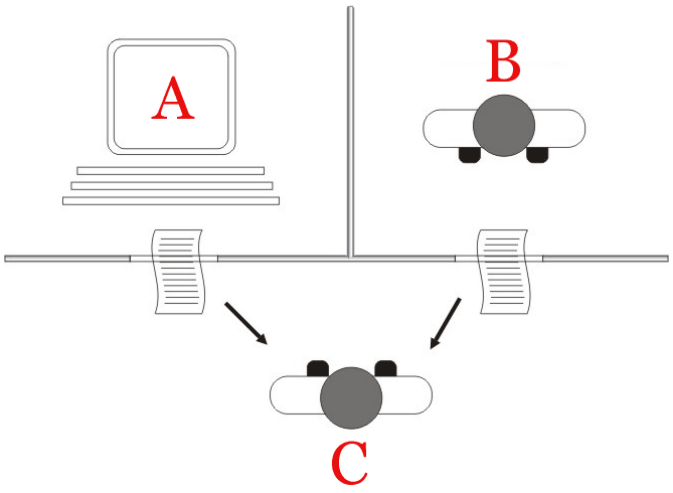


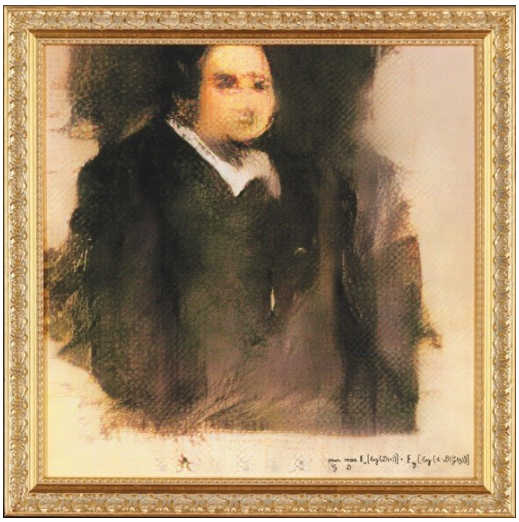
Fig. 6 Schematic drawing illustrating Turing Test configuration

The "standard interpretation" of the Turing test, in which player C, the interrogator, is given the task of trying to determine which player – A or B – is a computer and which is a human. The interrogator is limited to using the responses to written questions to make the determination ("Turing Test," 2020)

At this point in the research of AI and ML, a break was determined in order to further investigate a redeeming quality of Eliza acting as the said **"psychotherapist"** with a believable ability to ask questions and begin to converse with people while improving their state of being**. This directly connected to a review of literature and a book by: Warren Berger, A More Beautiful Question: The Power of Inquiry to Spark Breakthrough Ideas**. More in-depth insight from Berger's writings is discussed in the following chapter along with additional literature review content.

AI continued to move closer to the top of this project's investigation list, however, it did so with an uncomfortable uncertainty. Additional secondary advisor discussions hovered around variations and examples of AI in action, including typical rules-based AI and prescribed AI like Eliza above. This led to several video analysis sessions which included IBM's Deep Blue AI defeating world chess game champions in 1997, IBM's Watson AI defeating Jeopardy player in 2011 as well as Deep Mind Technologies computer program AlphaGo defeating world GO champions in 2016 (now acquired by Google).

More insight was generated through learning about Artificial Creativity (AC), the so-called unwanted sibling of AI which is the making of computer systems that can themselves create objects as opposed to simply analyzing with AI. It is here where the uncertainty shifted. While there is an active amount of AI development in this area previously described as generative design including a multitude of AI creative tools capable of generating artwork, film, product design, architecture and games---------- this begs the question of, what shall happen when we all have similar AC automation-like tools tomorrow? What will we rely on next? Or, for example, what will we rely on in moments of crisis-- feeling trapped, alone and unplugged from any digital or AI grid?



"The first-ever original work of art created using artificial intelligence to come to auction, *Portrait of Edmond de Belamy* (2018), smashed expectations at Christie's New York when it was hammered down for $350,000 after a lively bidding war that lasted for more than six minutes."

(*The First AI-Generated Portrait Ever Sold at Auction Shatters Expectations, Fetching $432,500—43 Times Its Estimate*, 2018)

Fig. 7 World's first AI produced art portrait of Edmond de Belamy

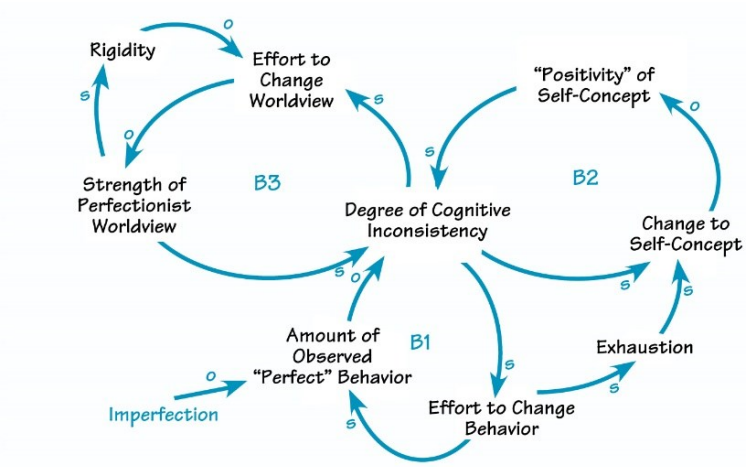
Additional AI and ML journal articles specifically mentioning computers as partners or even coaches eventually surfaced after a lengthy search. Two articles provided an interesting perspective which was in alignment with what had been loosely forming from the beginning of foresight scenario planning, the trend analysis work and 2 X 2 foresight matrix brainstorming tools. This will be discussed further in chapter three along with various other design tools.

1.6 A Respectful Intervention

With a clearer sense of a defined wicked, creativity problem, and semi-perplexed by additional layers of emerging artificial intelligence technologies, **the Artificial Creativity system has indeed begun.** And, while we may not find ourselves often unplugged from intelligent grids or smart devices to a level of concern in the future, the bigger and more **responsible question is one of sustainability**. More on the challenges and issues of creativity will be discussed in the proceeding chapters, however a point of pause in this research problem focused on the reoccurring notion that as individuals we emerge from childhood and consistently grow our fear of failure, determined to seek perfection in our work and in our lives. **There is empirical evidence that perfection, or Striving for Consistency, is the enemy of creativity** as it creates anxiety, procrastination, judgement and kills inspiration. ("Don't Let Perfection Be the Enemy of Productivity," 2020) This brings the research work for this project to also look closer at charting a system of perfection in order to further frame the current creativity crisis intersecting with AI. While this is covered in greater detail in chapter three under methodologies, the balance and sustainability of human led creativity comes into greater questioning, asking: what is systematically and consistently eroding our current creativity cycles and which AI may potentially spin it out of control to face yet another potentially more wicked, **Artificial Creativity crisis in the future.**

"The nature of perfectionism, along with the learning challenges it presents, can be charted using a causal loop diagram below. This diagram can give us clues about what drives perfectionism and offers ideas for ways to break the cycle of negativity that it can lead to. By worldview, we mean a set of beliefs that are typically held at a tacit, or unspoken, level. While people might find it difficult to put into words the underlying assumptions and beliefs that make up their worldview, these beliefs shape the way they react to situations that arise in their lives. ***Perfectionists generally hold a similar set of attitudes*** *that, when they expressed, might include the following:*

- *It is important to be a worthwhile person.*
- *To be worthwhile, a person must do everything perfectly.*
- *Worthwhile people never lower their standards "* (Charting the Challenge of Perfectionism, 2016)



"When a perfectionist falls short of their impossibly high expectations, the results are inconsistent with their worldview and self-concept, leading to self-destructive behavior and poor self-image. They can regain a sense of consistency by changing their behavior to again achieve perfection (B1), changing their self-concept (B2), or changing their worldview (B3) " (Charting the Challenge of Perfectionism, 2016)

Fig. 8 Systemic diagram charting perfectionism

1.7 CHAPTER ONE SUMMARY

As an introduction to this MRP, a wicked Creativity Crisis problem based on Torrance Testing spanning 30 years is described in North America made even more complex and challenging as it intersects with emerging formations of artificial intelligence and machine learning now mutating into artificial creativity. Ultimately, will this positively contribute to a human led creativity decline or simply disguise it for another future generation to inherit and be tasked to solve in a repeated manner? Or, worse yet, reach a point of no return as humanity hands over its creative abilities while technology presents opportunities to have less human involvement in the creative process? As creativity and innovation continue to be high on the list for future work and important to a nation's well-being and growth, creativity is held in high value not only for creatives and designers but for all domains and all fields. Several trends influencing the direction of this research were explored and two were prioritized where the emergence of various forms of AI technology moving into our lives along with activity surrounding societal mindfulness to look at what people are facing within ever greater fast-paced lifestyles. AI became an area requiring a deep dive to better grasp technologies and methodologies at play and begin engaging with an MRP secondary advisor as a subject expert. Similarly, a deep dive into creativity coaching was viewed as a rich source to gain insight from a panel of creativity experts via interviews. Realizing the magnitude of this MRP's topic issues, led to understanding that many factors might be at play affecting a culture of creativity decline stemming from various STEEPV areas, an in-depth and thorough plan is envisioned to arrive at a respectable intervention and opportunity for aspirational change.

2 WHAT ARE WE SEEING, HEARING, DOING, FEELING?

2.1 GENERATIVE DESIGN

While generative design (algorithms which create) may be viewed as a creative convenience due to its ability to utilize software to generate many variations of a design concept or viewed as a design collaborator or a grunt work assistant, many commercial examples are emerging. Depending on how this technology is used and re-used it may either be considered a supportive tool or equipment to automate the creative process with less and less human interaction. One example of a supportive tool is Microsoft's AI powered PowerPoint with its embedded **Designer** feature to guide and enhance a user's creation along the way at every step. A work piece begins with starting a new file, selecting a theme, inputting initial content and being prompted with a wide range of layout configurations, infographic icons and other design elements offered as **software determines what creative intentions may be at play.** Similarly, Autodesk's Inventor software designs and creates objects by receiving human inputted parameters such as dimensions, general form and configuration to define a three-dimensional model.

Recently, in 2019, such was the case with producing the first AI chair put into production by French industrial designer, Philipp Starck for the Italian company Kartell. Launched at the Salone del Mobile furniture fair during Milan design week, **the chair was designed by using generative design software** developed by Autodesk.

“This is the first chair in production created by artificial intelligence in collaboration with human beings”, said the software company. According to Autodesk, the A.I. chair is the first chair designed using artificial intelligence to be put on the market in the world. "Kartell, Autodesk and I asked the artificial intelligence a question: do you know how we can rest our bodies using the least amount of material?" Starck stated:

*"**Artificial intelligence doesn't have culture, memories or influences and so can only respond with its artificial' intelligence.** The A.I. Chair is the first chair designed outside of the human brain, outside of our habits and how we are used to thinking."*

“Starck used Autodesk's prototype software to create a strong, stable chair using minimal material, via a process that he described as "a lot like having a conversation".

*“Through inputs by Starck, the software went through a process of learning in order to create a chair that was comfortable, structurally sound, and adhered to both Kartell and Starck's aesthetic preferences. Autodesk described the final design of the chair as a **"collaboration"** between Starck, Kartell and the software.*

"Working with the AI-assisted system was a lot like a child learning," Autodesk said.

"As the conversation continued and Starck became more sensitive to the ways in which he described what he wanted, the refinement of requirements enabled the software to learn more precisely about his design intent, and ultimately become more capable."

“Autodesk said that the process of designing with the artificial intelligence software was reminiscent of "a child learning" The chair is produced via injection moulding, a manufacturing technique that the software was taught about so it would take the constraints of the process into account when coming up with the design. Autodesk believes that advances in artificial intelligence and generative design tools will improve the work of designers. Collaborating with artificial intelligence will increase the potential of human designers, Autodesk claims”

"Through a collaborative relationship with artificial intelligence, humans will find their design and engineering expertise amplified, increasing our capacity for innovation and productivity," Autodesk said.

(Philippe Starck, Kartell and Autodesk Unveil “First Production Chair Designed with Artificial Intelligence,” 2019)

Fig. 9 World’s first AI designed chair for company Kartell in conjunction with industrial designer Philipp Starck

Philippe Starck is a French architect and designer known for his wide range of creative design, including interior design, household objects and furniture, boats or other vehicles. From restaurants to hotels, furniture to space modules, Philippe Starck has put his ingenious stamp on more than 10,000 designs. Starck's output expands to include furniture, decoration, architecture, street furniture, wind turbines, photo booths, bathroom fittings, kitchens, floor and wall coverings, lighting, domestic appliances, office equipment such as staplers, utensils, tableware, clothing, accessories, toys, glassware, graphic design and publishing, food, and vehicles for land, sea, air and outer space. In 1997 he received the Excellence in Design Award from the Harvard Graduate School of Design.

As many other similar examples of human produced end products, services, experiences and ideas come to life in the future across all industries and domains, questions will arise for who or what is credited for its creativity. While final submissions of the above will carry various ratios of human and AI balance, an understanding through this research indicates that **artificial intelligence has its limits while also operating independently**. For example, it would be interesting to continue the above chair design exercise and further iterate for addition concepts using the same overall parameters. What could the same chair be as a three-legged configuration? Or a rocker? Or a stackable, nested design? Or project an aesthetic having a fusion of Bauhaus and De Stijl design period influences?

Ultimately humans, algorithms and its software developers will embody diverse levels of creativity until we reach a point of creative AI. Training AI to be creative is a concept for another research project. To continue within the scope of this project, it is believed by many seasoned creatives that creativity is not a tool nor a device, rather an ability. Creativity is a process and being creative is simply not a matter of generating wild ideas in a quick brainstorming session. (Lubart, 2005)

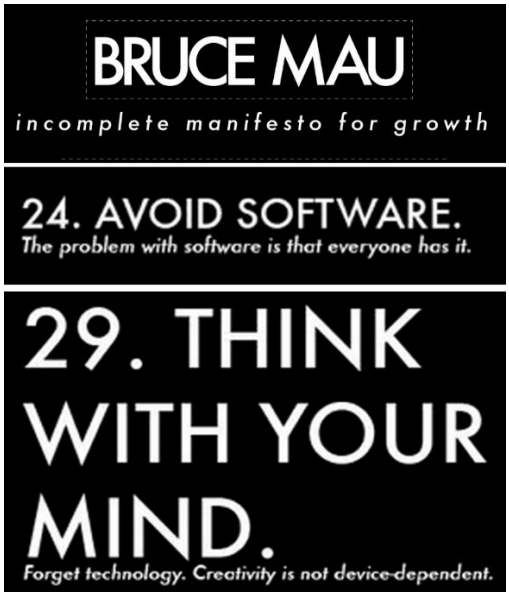


Fig. 10 Portion of designer Bruce Mau's poster for his incomplete manifesto for growth indicating avoiding software and creativity is not device dependent

2.2 AI AND COACHING

As a process, creativity benefits from professional development offered by specialized therapists, psychologists and professional coaches introduced in chapter one. As much as coaching is a form of development in which an experienced person supports a learner by providing training and guidance, coaching differs from mentoring by focusing on specific tasks and objectives. **The International Coaching Federation (ICF)** defines coaching as:

"Partnering with clients in a thought-provoking and creative process that inspires them to maximize their personal and professional potential."

In the article titled, **Artificial Intelligence in Coaching and the Job Market** published for Kingstown College Coaching Magazine 2019-2020**, ICF coach and economist, Christa Ilieve** discusses how in more and more jobs AI will perform better than humans without necessarily replacing them. Ileve begins with introducing **Artificial Intelligence combining with Internet of Things to have a range of characteristics with include:**

" *(i)* ***complexity****: with machine learning, AI can learn from other AI, (ii)* ***autonomous behavior****: depending on the application as AI software can reason, gather knowledge, plan intelligently, learn, communicate, perceive, and manipulate objects. (iii)* ***data driven****: AI entails data gathering, data processing and data analysis, (iv)* ***openness****: AI combined with hardware can create new tangible products and/or deliver services. However, AI has for now only a limited capability to mimic emotions.****"***

Ilieve further suggests that as AI enters the global workforce and labour markets, that similar profound changes will emerge in the coaching profession. AI coaches could theoretically understand more quickly the needs of a client thanks to data. Ilieve writes that one ICF initiative that has taken place was a launched by ICF France in 2018 entitled "Will AI be the coach of tomorrow?" and it raised the question on how to link artificial intelligence with emotional intelligence. The article continues to elaborate on how the coaching profession cannot exist independently from people and coaching thrives on changes in the world. Ilieve further lists some new coaching approaches and tools in an AI-transformed human society to include and might include among existing others:

"• Coaching Chat Bots and applications and self-improvement applications. ***For example,*** *AIMEE Kronos (AI for managers and employees), learning application Qstream; conversational interfaces, teaching assistants, digital tutors"*

"• Augmented coaching tools"

"• Coaching for specific jobs, using digital simulators"

Christa Ilieve is an economist who holds a master's degree in international economic relations. Christa has field experience in different environments including private and public sectors, and NGOs in several EU countries. Christa is a graduate of the Kingstown College advanced diploma, instrumental in leadership and executive coaching and pursues a professional coaching practice. Christa has also hosted solo and collective painting exhibitions and participated in brainstorming conferences and platforms on the impact of new technologies and artificial intelligence on society.

2.3 Computers As Partners in the Creative Process

In a 2005 paper, published in the International Journal of Human-Computer-Studies, titled **How Can Computers Be Partners in The Creative Process, Dr. Todd Lubart** explores the different ways that computers can be involved in creative work. A classification based on four categories of human centred interaction to promote creativity is proposed: (Lubart, 2005)

"Computers may facilitate: (a) *the management of creative work**, (b)** communication between individuals collaborating on creative projects,* ***(c)*** *the use of creativity enhancement techniques**, (d)** the creative act through integrated human computer cooperation during idea production. "*

Lubart writes and organizes suggestions offered in the eight papers on human computer interaction (HCI) for enhancing creativity along four lines of thought on the role of computers:

*"• Computer as a **Nanny***

*• Computer as a **Pen-Pal***

*• Computer as a **Coach***

*• Computer as a **Colleague**"*

He describes these four possible futures in the field of creativity along with issues concerning the creative process. **While his paper was compiled 15 years prior to this MRP** work and indicates computers as partners in creativity, it may be rationalized that much of the computing, processing, software and hardware discussed has evolved to present day technological advancements made in the field of artificial intelligence, machine learning and encompass internet-of-things previously discussed in this body of research.

1. Computer as a Nanny: Lubart states that creativity extends beyond simply generating wild ideas, and further indicates creative projects often involve prolonged periods of work. Work, in which **doubt, ambiguity, and lack of perseverance lead people to abandoning the creative process. He shares that a survey of successful inventors indicates that perseverance is the number one attribute required for creativity.** He indicates further that computers encourage creativity, monitoring the working progress and supporting the potentially creative person as they proceed. The example given suggests **helping people to handle time pressure by setting deadlines to keep a project on schedule and reminding the user of this contract, and/or monitoring the user's work and pointing out problems of procrastination, or problems of too many interruptions.** Additionally, a lack of breaks may itself lead to fatigue and sub-optimal performance, **computers could improve users' quality of life and perhaps foster creative incubation by proposing breaks.** Computers could help people set their agendas in line with their priorities, planning out activities to keep blocks of time for creative projects. Computers could also allow users to express creativity without being slowed down by technology to quickly record and save ideas as they formulate as a support for creative thought.

2. Computer as a Pen-Pal: Here, Lubart illustrates being creative involves communicating one's ideas to interact with audiences who evaluate, interpret and eventually integrate new productions into domain-relevant knowledge bases. He further states the importance of communicating with collaborative, creative acts involving two or more people suggesting that collective creative activities are increasingly common practice. Lubart indicates that such creative communities may facilitate their interactions through computer technology. One example is individuals with **personal digital assistants develop their own ideas and feed them into a global representation** which could be modified online. Computer based

representations integrate real objects which may be moved in physical space as people review and discuss. These representations have been found to facilitate the exchange of ideas between diverse actors. Electronic mail and electronic conferencing software allow collaboration between individuals across time and space. The potential for more diversified collaborative projects involving teams is possible and may enhance creativity. In this manner, the development of **electronic brainstorming software** which allows individuals to exchange ideas electronically, yielding a common pool of ideas which are submitted to group discussions **illustrates well the computer as a networker or facilitator.**

3. Computer as a Coach: As a third line of thought, Lubart explains how cognitive processes are involved in creative thinking and individuals do not master all of them nor are aware that certain kinds of thinking may be useful in a task. **Here the computer as an expert system knowledgeable in creativity relevant techniques may help the user go as far as possible**. Computers are able to provide information in different ways which allow people to generate creative ideas which may serve as mechanisms to **jumpstart** the creative process. Also, information about **existing techniques to stimulate creativity may be proposed.** Should a person be interested in trying to use a certain cognitive process such as divergent thinking, metaphorical thinking, or free association the computer could potentially **provide tutorials and exercises** to use as a workbench for creativity. The computer as a coach also fits creative design work. For example, systems used for facilitating design tasks, combines a database of potential sources of inspiration for object design with a diagnosis-assisting module to guide designers to new ideas.

4. Computer as a Colleague: As a fourth line of thought, Lubart shares that a most ambitious vision of human-computer interaction which involves actual partnerships with people and computers working hand in hand as a hybrid human computer system. The idea here draws on a work in **artificial intelligence** in which computers themselves are creative or contribute new ideas in a dialogue with humans. Here, a creative team composed of a **human-computer duo work with a proposed human initiated idea and the computer modifies it in a random way, which in turn the human modifies into a cycle which continues *until the user decides that the production is satisfactory.***

One tactic in creative thinking is to rely on random or semi random search mechanisms to generate novel, unconventional ideas. This is especially useful, according to many authors, when one is stuck and keeps revisiting a non-optimal idea. Computers may better implement random searches than humans, **but humans are needed to select the best ideas and hone these ideas, turning them into viable creative productions.** In fact, one criticism of artificial intelligent programs which claim to be creative is that a human plays a role at some point, which reduces the autonomy of the machine. From the human-computer interaction perspective developed in Lubart's paper, **these so-called failed AI creativity programs are examples of successful human computer interactions to facilitate creativity.** Lubart also suggests it is possible to conceive of computers as real partners in the creative process, intervening at different points in order to generate, evaluate or refine ideas and bring them to full-fledged products. Case studies of artistic creativity illustrate that computer technology may be incorporated in the creative act as a support for the creators visual or musical expression, and in this way the computer is fully integrated with human creative activity.

Todd Lubart concludes that likely, one single overarching creative process does not exist. Instead, there are a set of creative processes which vary with individual creative pursuits. No single HCI can be expected to satisfy all situations given that people vary drastically in their abilities, preferred working styles and personalities. Similarly, intellectual ability, such as analogical thinking, divergent thinking, selective combination skills and domain-specific knowledge also contribute to the uniqueness of one's circumstances. Thinking styles such as being more detail orientated or less, adds another layer as do personality traits concerning tolerances for risk, ambiguity, openness and perseverance, all contributing factors which interact to yield creative potential. Regarding the four different HCI categories Lubart lists, while people may very well want to have their computer act as a nanny, many others may find it annoying. Certain people will find electronic communication enhances their experience while others find it substandard to the traditional face-to-face interaction. Some will benefit from help menus which offer creativity techniques while others will find the assistance to be distracting. Some people are apt to be more willing to engage in creative thinking directly with their computer partner than others. **Ultimately, the key to designing a useful system may be to clarify a computer's contribution, how it fits with the creative exploration task and to what level the system addresses people's specific needs in order to reach the creative goals desired rather than being redundant or contradictory to people's own ways of operating. As a modern and updated system, full user control could be possible according to specific wants and needs for any given personal scenario.**

2.4 CREATIVE LANDSCAPE TEMPERATURE CHECK

Given the insight absorbed via the Kartell-Philipp Starck case study, along with the review of Christa Ilieve's article for Kingstown College and the study by Todd Lubart which are most in line with the vision of this MRP work, expert interview content data was compared, contrasted and ultimately contributed **to the amounting human factor needs resonating from what diverse, creative people require over machines to cultivate creativity.** The eight creativity coaches cited, who range from within the Creativity Coaching Association to independent practitioners who were contacted in order to discuss five key questions concerning creativity today. With an opportunity of hearing firsthand from a pool of actively practicing artists, coaches, therapists and psychologists, the **following five queries** were arranged for an in-depth look at current day creativity development with regard to barriers and supports while also capturing key expert opinions.

1. Do you feel that there are many resources to help foster creativity for youth and adults?

2. The Internet: As the world's library in our pocket and connected to so many people, places and technologies---------- how is this helping creativity?

3. I think it may be said that we are all born creative and have this ability, but is this something which requires work to develop, on a daily level?

4. What do you think are the most important elements to facilitate or support creativity? For example: thinking safe spaces, functional mediums to express thoughts, or the ability to process negative feedback, or others?

5. Generally, what do you find is helping people most today? What would be three top recommendations or rules to keep our creativity alive?

A strong consensus was present throughout **expert interview replies**. Information surfaced relating to both people's internal personal state and their external environments. Barriers and supports for each state are summarized and listed as follows:

INTERNAL BARRIERS: Critical judgment, pressure and unkindness from both the self and others topped the list, as well as exposure to the internet and social media as a large, mixed audience is not always supportive to one's creative culture. Lack of a stable circle of supporting, like minded creatives is a challenge in today's communities as many work independently with less cross pollinating than in the past. Low sense of purpose and contribution and not having enough of a "fire inside" and motivation to keep at it with hope was another barrier.

INTERNAL SUPPORTS: As much as creativity is deemed a process, it is an internal decision by people to live in such a manner. The onus is with the individual to design their respective lifestyle, daily routines and various exposures to society and stimuli. As large as the internet and technology resources are, there is opportunity to potentially and carefully navigate to a range of supports to aid in people's time planning and encouragement for deeper concentration, with less distractions and external noise. Mindfulness techniques growing in popularity may also aid creativity.

EXTERNAL BARRIERS: Societal speed and market competitiveness has reached a point where much is expected from us on demand which is not conducive to the inspirational and incubation periods often required within creative work. Additionally, the vast open creative market due to our online connectiveness tends to add pressure as a form of competition to discover what is generally considered good or bad art, design, work or expression. School system structures are notorious for not balancing explorative failing with academic success as many educators do not prioritize creativity (Gabora, 2017) and government standardized testing pressures (often referred to as "exam hell" by KH Kim) may be adding to this instability. Organizational demands of creativity as a commodity resulting in challenging pressure to perform in non-supporting corporate cultures. The internet continues to be both a source of resources but also a source of chaos, noise and distraction.

EXTERNAL SUPPORTS: The rise of maker spaces where creatives may tinker and cross pollinate are certainly a good start as are online groups and niche user forums where like-minded creatives may gather and connect. Technology and globalization have also allowed for many people to have access to

numerous physical resources ranging from small batch craft and fabrication materials, affordable outsourced skilled services and a range of Do It Yourself (DIY) support in the way of YouTube tutorials and digital visual reference libraries such as Pintrest. Successful attempts to align with social media may also provide enough positive feedback to motivate people to continue their creative work.

2.5 A KINDER-GARDEN

While fostering creativity is a growth experience for children, it has become one of **"unlearning"** for many adults as they step further away from their five-year old selves who once finger painted and engaged in imaginative play in preschool or kindergarten. The early years of school were typically a safe place to explore and fail forward, a time when many were constantly guided by curiosity and when questions upon questions were generated. A stage of life when many scored at a 95% genius level of thought and a place where many non-creative adults actually revisit today while dreaming. What if we could live a future without wasting any of the learning we do as children? How could we continue to learn and play as children in our adult years and within our careers without being frowned upon? Or viewed as naive, immature and unprofessional? **How might we be kinder to ourselves and others within creative pursuits?** What would that kinder environment be? How might we comfortably continue to ask the many questions we did as children and have an ability to answer them in any, creative way we wish? How might artificial intelligence help us? How might AI act as a creativity companion? Was AI's early attempts through IBM's Eliza on to something? Is it okay to ask all these questions?

As an additional literature review contribution to this MRP along with Ilieve and Lubart, a range of supporting sources were reviewed through Warren Berger's 2014 published book, ***A More Beautiful Question-The Power Of Inquiry To Spark Breakthrough Ideas.*** Berger touches upon several contributors in this MRP work while **including several others on what our future requires to be creative.** Through Berger's research and contact with the world's leading innovators and creative minds, he provides a convincing narrative on how we have evolved to a point where we are inundated with answers and that **questions are becoming more valuable than answers as we swim in all the data surrounding us today.** Berger introduces Joichi Ito, the director of MIT's Media Lab, who shares his theory on lifelong adaption:

"*When the world moved at a slower pace and things weren't quite so complex, we spent the early part of life in learning mode. Then once you became an adult, you figured out what your job was and you repeated the same thing over and over again for the rest of your life. Because of constant change and increased complexity, that rinse and repeat approach in adult life no longer works as well in a time when so much of what we know is subject to revision or obsolescence.* ***The comfortable expert must go back to be a restless learner.*** *As we try to come to terms with a new reality that requires us to be lifelong learners instead of just early life learners, we must try to maintain or rekindle the curiosity, sense of wonder, inclination to try new things, and ability to adopt and absorb that served us so well in childhood. We must become* ***neotenous****, which means the retention of childlike attributes in adulthood.* ***To do this we must rediscover the tools that kids use so well in those early years."*** - Joichi Ito

Berger moves on to describe the WHY, WHAT IF, HOW sequence which breaks down the creative problem-solving processes used by **design thinking** groups such as IDEO and other leading designers to systematically solve problems. With "WHY" being the problem "framing" of a problem, the next steps are generation of ideas which corresponds to the "WHAT IF", **and then building upon those ideas in the form of physical prototypes to address the "HOW".** In a similar vein, Berger speaks of Min Basadur's problem solving processes which consists of a classic four stage process of **Preparation, Incubation, Illumination and Implementation.** A progression which moves from understanding a problem to imagining possibilities, to going to work on possible solutions.

Van Phillips, inventor of the world-famous Flex-Foot Cheetah Leg artificial limb design is showcased by Berger drawing upon key attributes and insights during the invention of such a revolutionary successful new product. As an athlete and amputee, Van took it upon himself to learn, design and implement a new type of artificial limb. As a novice inventor, beginning to gain expertise in prosthetics he **tried to maintain an "outsider" perspective,** even while advised by a mentor to review all that had been done before which was freely viewed on all world patent databases. Phillips reaction was that he did **"not want to pollute his mind with everyone else's ideas.** I'm following my own path and not anyone else's". As someone who was not in a hurry, he further shared that: **"If you give your mind time and space,** it will do its own work on the problem, and come up with interesting solutions". Berger continues to explain that **exploring WHAT IF possibilities is a wide open and fun stage of questioning and should not be rushed** as trying to answer difficult questions too quickly is the worst we could do. Fresh, **WHAT IF possibilities take time to percolate and form, often benefitting from connecting with existing ideas in unusual and interesting combinations.** Berger shares how **Einstein was an early believer in this form of "combinatorial thinking" which today is viewed as a primary source of creativity.**

Fig. 11 Flex Foot Cheetah Leg artificial limbs on running athlete by inventor Van Phillips

In line with what we learned through Kyung Hee Kim's Creativity Crisis research, Berger extracts from a portion of Dr. Kim's research a finding which indicates that "on average, preschool children ask their parents 100 questions per day and by middle school have stopped asking". In a 2009 National Report Card analysis presenting the steep decline in questioning against high levels of reading and writing, Berger **suggests that we might conclude that children don't need to question as much once they are reading, writing, texting and perhaps *Googling.***

Further into Berger's book, we hear from IDEO's Paul Bennett on "safe-spaces" for creativity and naïve questioning. Bennett explains:

"I position myself relentlessly as an idiot at IDEO, and that's not a negative, it's a positive because being comfortable with not knowing is the first part of being able to question".

"I am able to ask incredibly naïve questions without feeling the least self-conscious."

"Our company recognizes it's important to create an environment where it's safe to ask stupid questions. *You need to have a culture that engenders trust, part of questioning is about exposing vulnerability and being okay with vulnerability as a cultural currency. No question is too basic to ask and co-workers are encouraged to support and build upon others' questions rather than dismissing them or giving pat answers,* ***we allow people to fall backwards and be caught by one another".***

Moreover, Berger touches upon what some may refer to as creative purpose and askes: "Why are you climbing the mountain? Here he refers to questioning for life which may very well covert to creating for life or creating for one's own personal journey. Often people are creative in one area of their life in order to affect another area of their life such as the weekend warrior culinary artist chef who suits up as an accountant during the week. While some may call this a creative outlet, active creative core people understand that they are simply investing time-----for themselves, as the creative animal they are and have managed to retain tools from childhood. Berger shares how schoolteacher David McCullough (son of the Pulitzer winning historian), gave a graduation speech which was a viral internet sensation: **"Climb the mountain not to plant the flag, but to embrace challenge, enjoy the air, and behold the view. Climb it so you can see the world, not so the world can see you."** Here Berger writes that creating happiness is ongoing, you don't find it, you gradually figure it out for yourself, questioning and experimenting as you try to understand what makes you feel happy and how to have this in everyday life. **Gretchen Rubin of the Happiness Project and life coach Eric Maisel both suggest that people ask themselves some version of the question "What did I love doing as a child?"** (Berger, 2014)

2.6 EMERGING CONTRIBUTIONS OF AI

Elaborating on the aforementioned types of artificial intelligence, which included variations of machine learning and its neural networks, artificial creativity as the artist and composer and internet of intelligence via combining IoT with AI, we are seeing various packages emerge not only online, but into our homes, education, workplaces and marketplaces. Whether many are aware of AI's presence or not, it is increasingly integrating into our everyday life. While a comprehensive study of AI and its diverse abilities and applications is not the core focus of this MRP, there is significant published knowledge available to us in order to appreciate and begin to use within the design and planning of future products and services. For this, we turn Milkos Philips who is a User Experience (UX) designer, product design strategist, author and speaker with more than 18 years of experience in the design field. In Philips' 2018 article: The Present and Future of AI in Design, Philips writes about the ongoing conversations between designers and developers around the future impact of AI, Machine Learning/ Virtual Reality/Augmented Reality/Mixed Reality and Deep Learning. Philips shares these thoughts:

"AI magic is here to save the world, making us giddy with excitement and terrifying us at the same time. However, AI is still mostly unknown, and figuring out exactly how it will work in the design world is pretty much like trying to figure out how many angels can dance on the head of a pin". (Philips, 2018)

Philips mentions AI has become an over-hyped buzzword across many fields and that new relationships will be needed between customers and products. These interactions will only be the beginning of what AI could and should do for products and services.

*"Designers will bring the necessary **empathetic context for innovation**, which is how a business will succeed with AI. AI holds a lot of potential for the design world, but for this to happen the hype around it needs to be deconstructed. It would better if designers cleared their minds and didn't think about AI as "artificial intelligence"–as though AI was going to work as some kind of magic-tech. A more useful way to think about AI—at least for the short-term—is **Augmented Intelligence**."*(Philips, 2018)

According to Philips, AI will mostly be concerned with optimization and greater speed. Designers working with AI will have an ability to create design faster and more economically. The power of AI will rest in the speed in which it may analyze large amounts of data and suggest various design adjustments. A designer would then be able to make selections and approve adjustments based on that data. The most effective prototypes could be created expediently and tested with end users. Below are several examples of where AI in design shines presently and where it will lie in the future:

1. Design Tools:

"AI design tools help designers create winning designs more quickly by automatically refining a product's design based on millions of other successful ones. It can also suggest entirely new design alternatives and report how and why these would improve user engagement."

2. Ecommerce:

"AI helps designers personalize E Commerce sites as well as design more effectively overall. A branded baseline design is created by a designer, and AI personalizes they experience for shoppers on the fly based on their profile and billions of data points."

3. Facial Recognition:

"Through facial recognition and computer vision AI is able to determine gender, age, location context, and the current mood of the user. UX designers can deliver more personalized experiences based on this information"

4. Voice Recognition:

"Coupling AI with voice recognition and chat bots enables UX designers to create speedier, more convenient and personalized experiences. It is projected that the number of people using digital assistance will rise from 700M to over 1.8B by 2021"

5. Data:

"Analyzing vast amount of data, AI helps designers design higher performing products based on the best converting-designs, UX best practices, conventions and standards, and known usability metrics"

6. Screen Content:

"Based on thousands of previous studies, AI co-creating with designers predicts how users look at and read content on a screen, so designers can direct attention towards important areas"

7. Unique Combinations:

"AI can generate millions of unique versions of home pages and landing pages for new sites and media brands based on user profiles preferences and tracking data"

8. Solutions:

"AI generative design allows multiple design solutions by simply putting in a goal or defined problem"

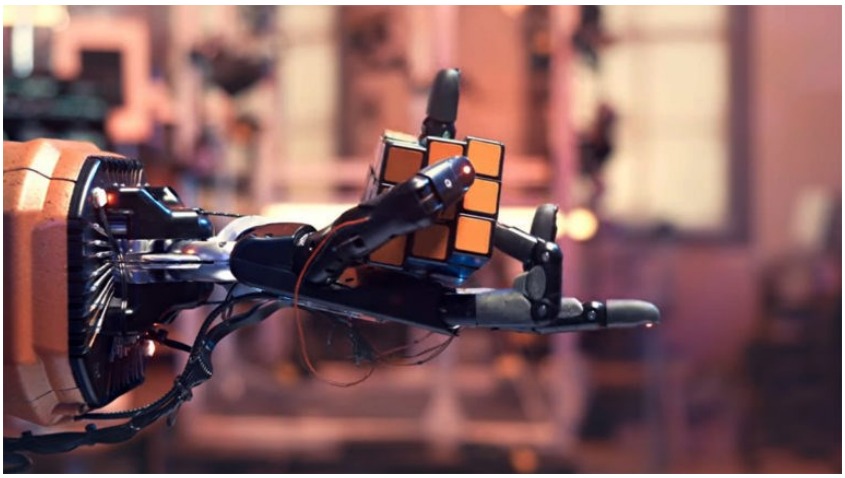


Fig. 12 An AI operated robotic hand solving a Rubik's cube, one-handed

9. Create:

"AI is able to assist designers in creating millions of unique products and unique versions of packaging while maintaining the brand style and design integrity"

Given the above AI capabilities and other amazing computing features enabled by sophisticated algorithms and technology today, we are at a point where designers can logically begin to implement various applied technologies to enhance and evolve human experiences. The ambitious quest for this MRP work is to ultimately address the human development of creativity for a thriving next generation, but also a quest for a **responsible, humane, life-centered design future.**

The world has witnessed a range of AI fueled robots, devices and applications of late ranging from the creatures of Boston Dynamics, to a semi-humanoid and charming "Pepper" from SoftBank Robotics, along with a first-to-receive citizenship Sophia human-like robot, by Hanson Robotics, and trickling down to smaller versions of "Little Sophia", MIT's Jibo as what was destined to be the world's first social robot and finally, some of the most commercialized and mainstream smart speakers such as Amazon's Echo and Alexa as well. While any one of these may stand to deliver a level of an AI creative development learning experience, a multitude of questions and concerns arise. In order to begin solving for the many unknowns, we must carefully open a foresight design thinking tool chest of methods and techniques in order to begin a degree of sensemaking and learn where opportunities for change may lay.

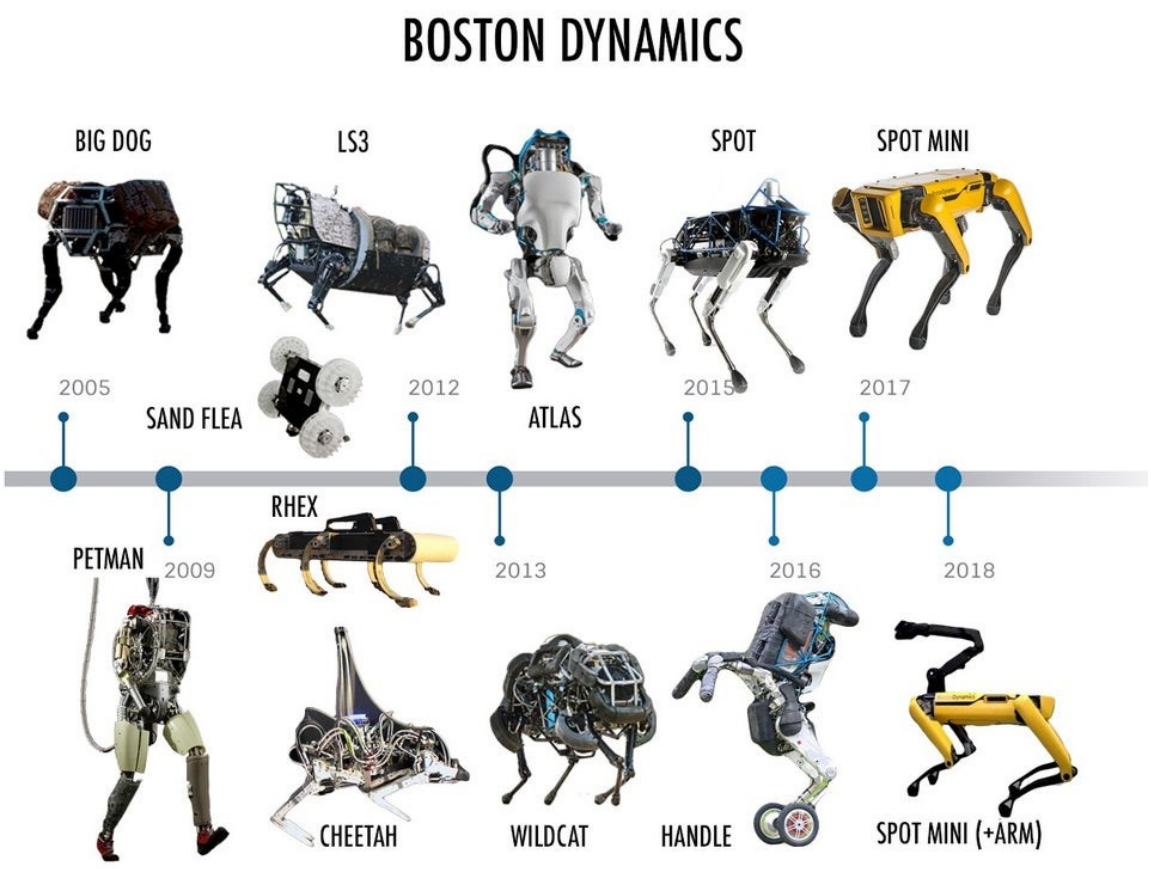


Fig. 13 Timeline image of Boston Dynamics' various AI powered robots from 2005 to 2018

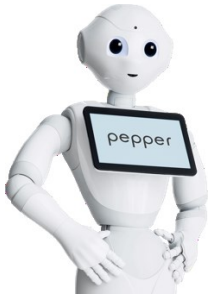


Fig. 14 Pepper robot

Fig. 15 Sophia robot at CES 2019

Fig. 16 Little Sophia robot

Fig. 17 World's first social robot JIBO, various views

Fig. 18 Amazon's Alexa and Echo items

Fig. 19 Mindbloom app screen

Fig. 20 Rocky AI coaching chatbot

2.7 CHAPTER TWO SUMMARY

To provide MRP context and draw from various literature review and sources of research information for this project, much insight is gained from a complex world of creativity surrounding us. Through articles, papers, case studies and creativity expert interviews, declining creativity is a problem indicating that some underlying issues are more human factor and technology management based than skill or talent related. Reviewing information from coaching and creativity professionals one grasps that influences impacting the fostering and maintenance of individual creativity is not so much a lack of creative methods, or lack of physical tools or lack of ideas, rather, it is more about the external environment surrounding individuals which in turn effects internal personal factors. Although the initial problem framing direction in this MRP may have been pointing to AI as a new force to augment creativity activities, a clearer direction is to **utilize AI in assisting the true human power** of creativity in a noisy, overabundant and critically complex world full of distraction. It is reassuring to have reviewed an ethical, transparent use of AI in furniture design with Philippe Starck and of AI emerging into professional coaching from Christa Ilieve along with an alignment to Todd Lubart's work to see computers (with suitable AI and algorithms) as partners in the creative process rather than equipment

to automate and simulate human creative energy. Creative energy which is child-like and curious as described by Warren Berger, and an energy which has traditionally been supported by parents, educators and mentors. Questions from this point are: how might we package an assistive AI system to support creativity using all which AI promises as described by Milkos Philips and more AI capabilities as this technology evolves? Is another smart-robot a solution? With humanoid characteristics? Might that assist or intimidate? Would it be her/him/they and why? Or simply another smartphone application to run as software in our lives?

3 NAVIGATING THE CHAOS

3.1 EMBRACE, DREAM -------DO SOMETHING.

As a research question reflection for this MRP: "***How Might We Embrace Artificial Intelligence and Apply it to Fostering, Personal Human Creativity?"***, the first portion on AI alone seemed like a daunting task as this project struggles to fully understand the future impact of AI we will face. Having reviewed several case studies of implemented AI along with the aforementioned scholarly literature reviews from chapter two and the analysis of trends influencing this work **allows an informed decision to be made, which is to embrace and carefully accept what may be intellectually maintained as responsible, industry-ready AI developments and venture forward through aspirational and ethical lenses,** as a similar approach to AI which is being used within Canadian government and controlled to ensure it is governed by clear values, ethics, and laws. (Secretariat, 2018)

Although we continue seeing forms of AI experimentation or even AI creating new AI, a level of sense making indicates **humans are involved extensively and for the most part, are in control, contributing to positive change and co-creating.** Armed with a level of promising AI capabilities allows for design methodologies to move forward, design, develop and perhaps even ***dream.***

Dreams are powerful, they inspire us to imagine things radically different than they are today and believe we can progress toward this imaginary world. Design's inherent optimism leaves no alternative, but it is clear that many of the challenges we face today are unfixable and the only way to overcome them is by changing our values, beliefs, attitudes and behaviour. (Dunne & Raby, 2013) In their book titled, Speculative Everything, Anthony Dunne and Fiona Raby share their fascination with Stuart Candy's 2009 presentation of **The Cones of Possibility** while visiting the Design Interaction program at The Royal College of Art. As a foresight tool, variations of the visual cones fanning out to the future from present helps to describe the **different levels of likelihood.** With the cones indicating what might be Probable, Plausible, Possible and Preferable, it guides design to plan for many future scenarios starting

with “what-if questions”. **Given the complexity of designing for how AI might be our creativity companion one day, the Cones of Possibility framework is a fitting method for this project as is scenario planning using four of the leading trends discussed earlier in chapter one.** In fact, the Cones of Possibility has been proposed several times before and after Candy originally conceived by Charles Taylor in 1988. Also known as the Voroscope, or simply Futures Cone (Voros, 2017) this research direction resonated most with what was seen by Dunne and Raby’s iteration below by incorporating elements of utopian and dystopian vision. While early versions of the Futures Cone included three to four levels of possibility (possible/plausible/probable, and preferable) recent adaptions include a fifth and sixth level to include “Projected” and “Preposterous” as seen in Joseph Voro’s “Voroscope”.

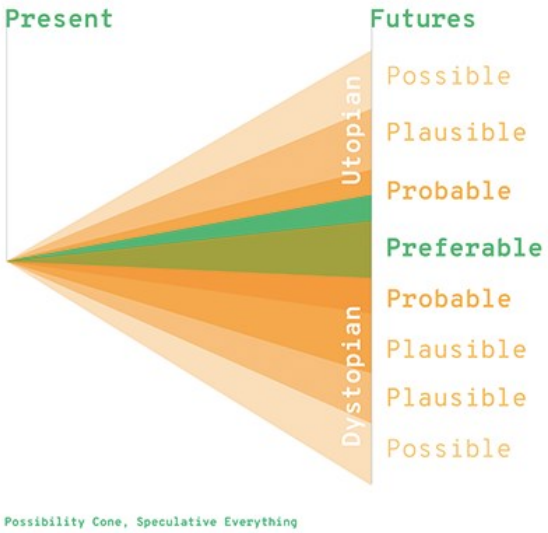


Fig. 21 Speculative Everything Futures Cone

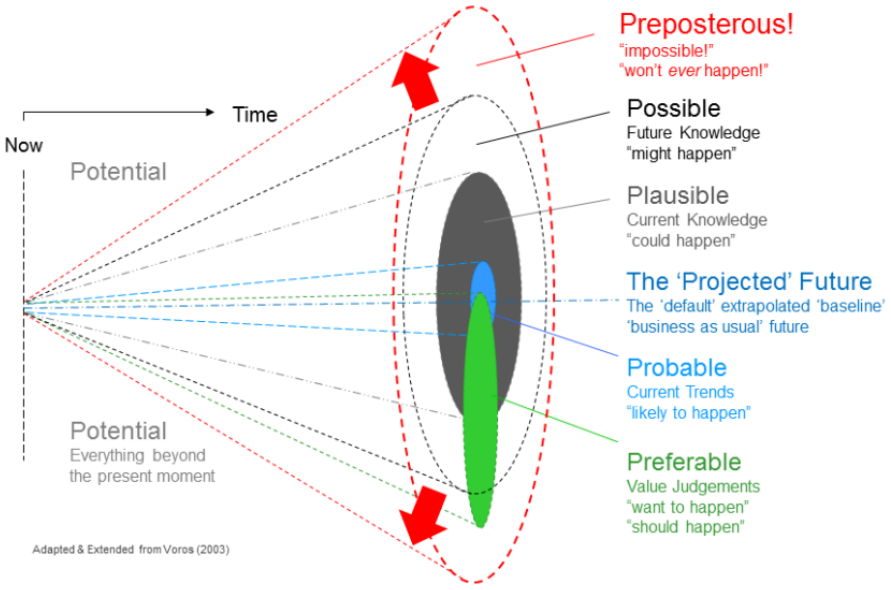


Fig. 22 Voroscope Futures Cone

Given the dystopian issues surrounding artificial intelligence such as the unfortunate reality that AI will replace many human jobs, a desire to coalesce and further evolve the said futures cone was established during this research to include all six levels of possibility (with preposterous allowing for dreaming) and cone features for both dystopian and utopian values, concerns and responsibilities. With a goal to reach a framework to ***Dream Responsibly***, the image below was created below to support what many designers do typically and referred to as "blue-sky thinking", essentially idea generation not grounded in reality and limitless.

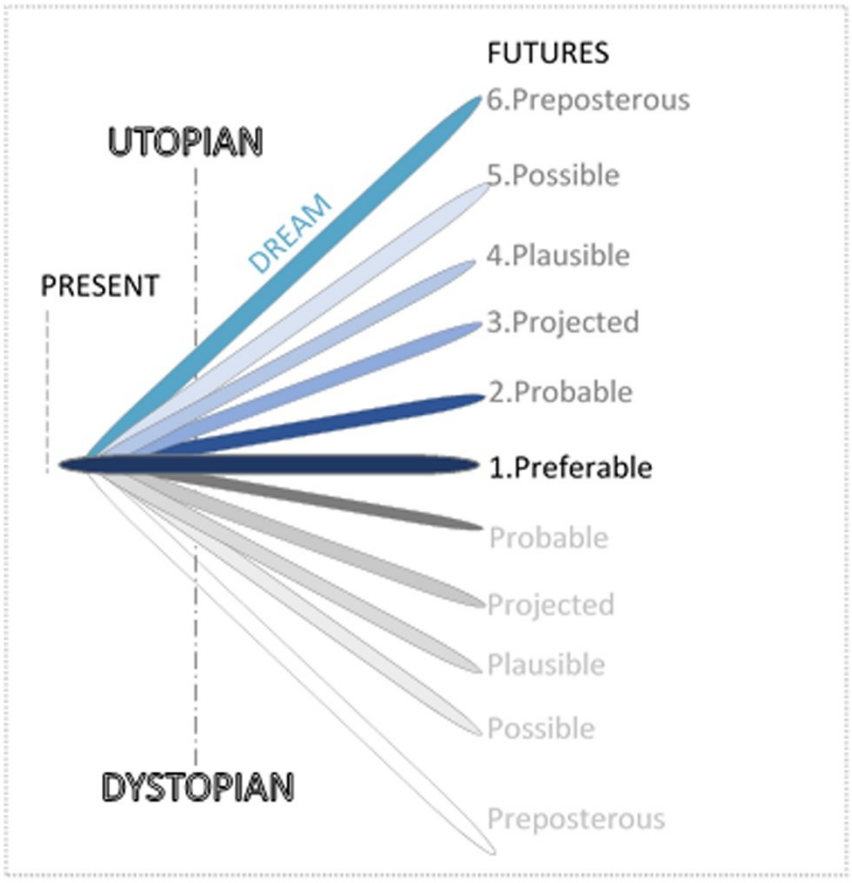


Fig. 23 Revised, amalgamated Futures Cone combining Fig. 21 and Fig. 22

Similar to the Futures Cone, with features to dream new realities and incorporate present day myths, the **Causal Layered Analysis (CLA)** foresight tool was selected as a second sense-making and scenario building technique. Developed by Dr. Sohail Inayatullah, the CLA allows for exploration of underlying causes and worldviews contributing to a situation. With familiar elements of a system's thinking Iceberg Model, the CLA tool consists of four levels:

- **Litany:** To include what is felt about a situation.
- **Causes:** To understand what is creating the situation.
- **Worldview**: To view different perspectives shaping the situation.
- **Myths:** To grasp underlying storied which are feeding the situation.

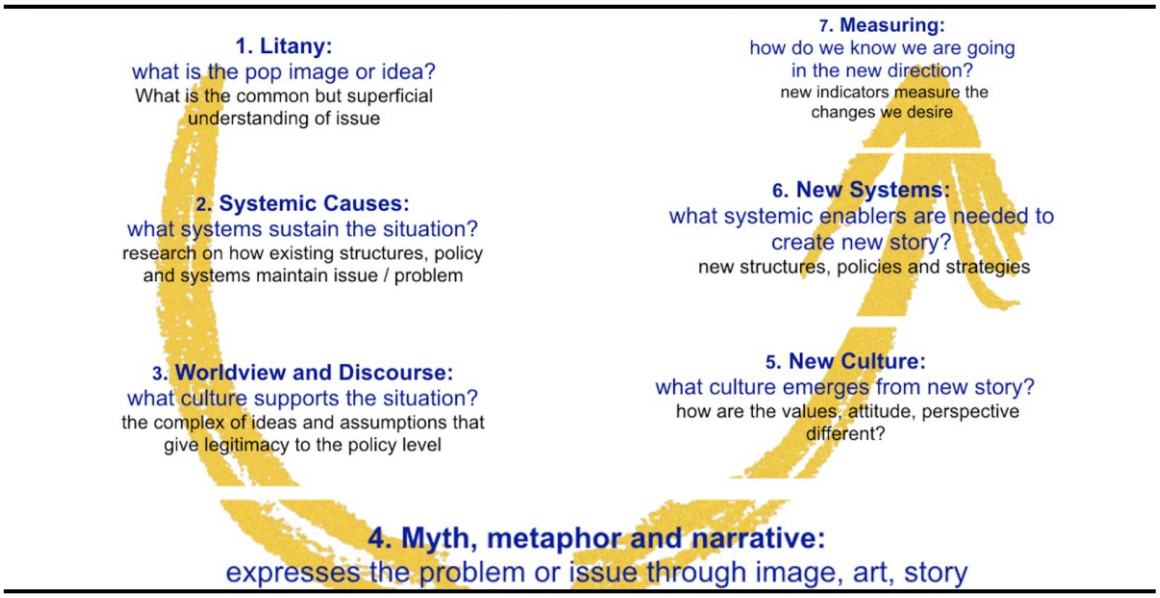


Fig. 24 Causal Layered Analysis framework model indicting seven layers

A fully developed and final CLA is looked at in detail in chapter four along with additional findings of this MRP. As mentioned in chapter one, initial sensemaking and scenario building for this MRP began with trend analysis and selecting four key trends which were felt to most influence the direction of this study. Of four trends, two were arranged in one 2x2 scenario building matrix and the remaining two in another 2x2 matrix. Much of this exploration tied in with current day and near future realities as secondary, published information allowing scenarios to emerge which appear to be feasible, viable and likely desirable as the IDEO innovation formula depicted earlier in this MRP. A 2x2 scenario matrix technique, often used for building quick scenario narratives, arranges two drivers of the **highest importance and with the greatest level of uncertainty.** The initiate 2x2 layout below is further detailed and explained in research findings in chapter four.

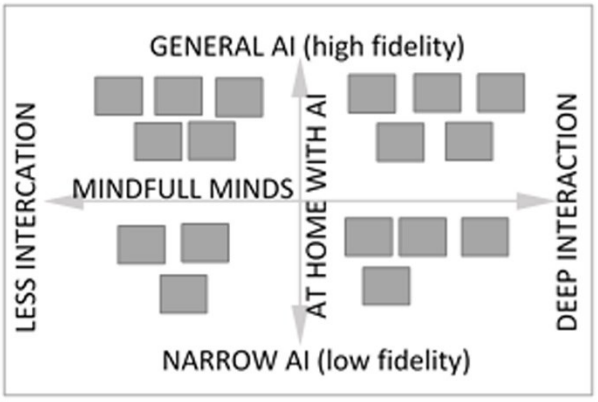


Fig. 25 2x2 scenario set for first two trends

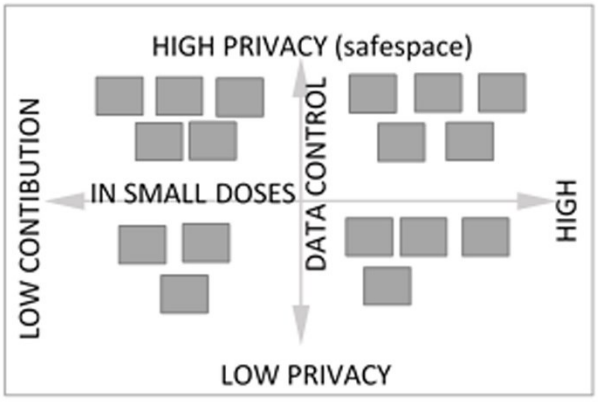


Fig. 26 2X2 scenario set for second two trends

Jeff Bezos (Amazon's Founder) famously said, "it is important to also focus on what does not change in the next ten years" (Condon, 2019). In Amazon's case, this is great pricing, customer service and a vast selection of goods and services. Inspiration from this mantra rolls into this research asking similar questions:

In ten years will people, parents and industries one day not want human generated creativity or wish to not express a unique opinion or idea?

Would fostering creativity as a child or continued development as an adult be completely revolutionized to a point of only digital transmission of thought leading to a finished outcome without a presence of a physical artifact? No physical prototype? No trial of mock-ups and learning by doing? Will brain implanted chips simply configure with machines to paint artwork, 3D print product, build buildings, create music and solve health problems-------Think it, and it happens? Although, Elon Musk and Neuralink are working on this for paraplegic applications allowing paralyzed people to control smart phones and computers, it is not a foreseeable future as far as human creative abilities are concerned, we hope. In a similar vein of thought, questions surfaced to wonder about humans and their interaction with physical products, tools and experiencing their environments. While we are witnessing trends of minimalistic lifestyles and less of a possession obsession with product, are we done with **assistive tools** and devices in our lives anytime soon? In our homes? Will software eventually replace much of our hardware? Given this research project on creativity and initial problem solutions are being built out toward a next generation of implementation, in five to ten years, the answers to many of these listed questions are hopefully, no, not likely in three to five years. However, as alternate forms of computing evolve, wearables become smaller, more sophisticated and, perhaps in ten years' time, implanted with our bodies----a very plausible reality.

3.2 Opportunity for Change

Given the range of examples for AI powered product/service solutions as seen with figures 11 to 18 in chapter two and adding to these below, figure 27 provides a sense of solution benchmarking, or visualizing where a new opportunity might reside to potentially serve a gap or, in this project's case, **conceive a respectable intervention.** While AI may serve as the majority of a plausible solution for this project, AI will require a medium to serve the second portion (hardware peripherals) of the research question applying it to foster creativity within adults and/or children. While this intervention is described and detailed more in chapter four as findings and contributions, a research deliverable is leaning toward addressing children over adults at this point. Referring to the chart in figure three, we learn that generation Alpha (born ~2010-2025) is a generation of children currently at risk for a continued future of creativity hardship with ever growing internet and social media negative influences. With that, this project begins to look at existing solutions on the market and notes various devices and technology used to reconfigure internet use for children. Such is the example with Circle by Disney which is an internet router accessory used to block content, filter activity and provide greater parental control. This project work aims to move beyond this and view AI as an additional layer to achieve **amplified parental control and design for a more comprehensive creativity fostering environment for children, online and offline**. An environment simulating what Todd Lubart has described as computers as partners in the creative process. Additionally, an environment where AI performs to provide the guidance and support parents, educators and mentors champion and often may struggle with as children try to navigate the internet and better balance technology and life as children to avoid the growing concerns of digital addiction. (Klass & M.D, 2019) Reimaging the internet as cleaner and more controlled is only a beginning as children require more which will be detailed in chapter four as advised by Dr. Kim who suggests a key **Four-S Climate Environment.**

Fig. 27 AI and Mindfulness 2x2 scenario set as product benchmarking

3.3 LEARNING BY DOING

As a final methodology element addressing this MRP's research question, both industrial design and interaction design techniques are visited. With a vast collection of sticky notes and documented information generated for this MRP, including data from expert interviews, trends analysis, and scenarios derived from 2x2/CLA/Futures Cone frameworks, freehand conceptual sketching was explored. As a visualization technique:

"Concept sketches convert ideas into concrete forms that are easier to understand, discuss, evaluate and communicate than abstract ideas described in words. Sketches powerfully augment written descriptions and help ideas to be communicated more rapidly and effectively since sketching is about making an abstract idea concrete it makes us think through the issues of embodying the idea in reality and it gets us closer to refined concepts in doing so it often sparks more ideas for further exploration. Iterating and reacting to sketches often leads to many more new concept, sub- concepts or concept improvements than just Ideation based only on only abstract thinking." (Kumar, 2012)

Typical industrial design groups such as IDEO and FROG Design begin concept ideations as a range of rough figurative drawings that are effective for quick visualization and later refined visual renditions to express what ideas really look and feel like. Most often, sketches are also performed with various influences and inspiration from historic design periods, current styling tends and incorporate aesthetic details suggesting materials and manufacturing finishes. **With refinement, additional elements are factored in which include product ergonomics and product semantics. Semantics which primarily represent design meaning within an emotional, psychological, social and cultural context.** Additionally, a visualization--a mood board collage of images was created with a range of imagery to attempt to answer design questions such as: What form of a device could an AI powered Creativity Companion be? Is there opportunity for something more than just another smart phone application? What other interfacing can be of benefit? What other similar products can be positioned as competing/benchmarked examples? **What are consumers familiar with and what would help in transitioning to such a device to aid in fostering creativity?** For children? For adults? Home and office environments or both?

Following an initial run of concept sketching, reflection, refinement and more visualizing to understand a first round of scenarios, next steps were made to produce three-dimensional study models. Study models, in the form of low fidelity mock-ups were 3D printed to study possible solution prototypes. Also listed in Vijay Kumar's book, 101 Design Methods, Concept Prototyping is used to:

"*Assess the adoptability of an early concept with potential users by giving it **physical form that can be experienced.** Concept prototypes embody the principle of **"building to learn"** in that the process of giving a physical form to a concept facilitates discoveries about it that often cannot be foreseen until it*

is made tangible by giving people something tangible to react to, concept prototypes can trigger thinking about alternatives or necessary revisions to initial concepts or can help inspire alternative concepts they also provide fertile grounds for conversation about future possibilities concept prototypes address both the appearance and the performance of the offering. What emerges from the method is a kind of "reality check" that helps to make well informed decisions about the direction a concept needs to evolve.

Lastly, further guiding the above design process is a revisiting of what is understood as the user centered or human-centred-design (HCD) process. With regard to designing a Creativity Companion potentially as a first physical artifact and/or a first type of interaction experience of its kind, a mixed method approach is embraced. With HDC established as more of an incremental design approach, often leading to evolutionary design successes, designers cannot always rely on present day user activities, ethnographic study outcomes and near similar experiences to design and deliver a new offering which may be more revolutionary than evolutionary, otherwise known as radical innovation brought upon us by advancements in technology and meaning change rather than simply design research. (Norman & Verganti, 2014) In their paper, published 2014 for Massachusetts Institute of Technology, Donald A. Norman and Roberto Verganti discuss Incremental and Radical Innovation by looking at Design Research versus Technology and Meaning Change. Here, Norman and Verganti share insights to help further augment this MRP's design methods:

"Radical innovations such as Facebook and Twitter have come about because their inventor's thought they were interesting things to try, Norman was unable to find any example of radical innovation that resulted from the HCD process. HCD, he stated, was only suitable for incremental innovation"

"Norman argued that radical innovations were driven by technology changes, without any research or formal analysis of needs. Once the radical innovation had been developed, however, HCD was invaluable as a way of improving the product and enhancing its appeal---good examples being the way that Google, Facebook, and Twitter have modified themselves since their initial introduction, or how automobile manufacturers slowly and continuously modify their offerings".

"Virganti's views were similar to those of Norman. The two agreed regarding the importance of HCD for incremental innovation and its weakness in radical innovation. They agreed regarding the importance of technology change and driving radical innovation"

“Technology epiphanies bring a radical change in meaning enabled by emergence of new technologies or the use of existing technologies in totally new context, the Wii video game console and the Swatch watch are examples of this type of innovation, customers were simply not asking for fashion watches and gamers were not looking to become physically active while playing.”

“Verganti went one step further, he demonstrated that radical innovation could also come about through changes in meaning while presenting at the Designing Pleasurable Product and Interactions conference in Milan in 2011”

“Meaning driven innovation starts from comprehension of subtle and unspoken dynamics as sociocultural models and results in radically new meanings. The invention of the mini skirt in the 1960s is an example: it was not simply a different skirt but a radically new symbol of women's freedom that signaled a radical change in society, no new technology was involved.”

Given the unforeseen complexities with designing for successful, artificial intelligent charged products and experiences, it is a project goal to incorporate a mixed method approach, where it best answers the research question. The scope of this MRP is one where initial concept generations take place as a phase one for both an AI software platform, a physical hardware device (and perhaps peripherals) as interactive, interfacing components. The methodologies listed here represent a unique and comprehensive approach in order to define overall design experience recommendations, physical product details/features, creative execution product strategies and a business implementation strategy introduction. As per the brief indications of a goal toward Life-Centred-Design (LCD) in this MRP, it is a desire and responsibility felt to evolve Human-Centered-Design to Life-Centred-Design as a greater initiative toward economical, societal, environmental sustainability. Reflections on methods used and outcomes are discussed in chapter four along with findings, and research question answers.

3.4 CHAPTER THREE SUMMARY

Ironically enough, this MRP has reached a point where creative energies are required to be called upon. And, although one day AI may very well be capable to conduct this research and produce a comprehensive report, key foresight methods and tools coupled with design thinking allow for expansive views and creative synergies of limitless thinking. With problem finding in chapter one leading to problem framing through chapter two, here in chapter three, an arrangement of suitable foresight methods provides a framework to equip this project in order to further delve into problem solutions in the next chapter. Looking to embrace Artificial Intelligence to a point where it was felt it could be a responsible future element was important and identifying techniques and methods along with moments of reflection was also critical to formulating findings within this MRP. With creativity as a concern for both adults and children, the goal of this work and evolving forms of AI defined is viewed as an opportunity to focus on children making up the next Alpha Generation as a possible intervention and chance at making plausible change. A change in a creativity decline and a change to utilize AI not only as digital navigation but as aggressive parental control of the internet to provide children with a learning and creativity growing environment packaged in what might be a physical and symbolic, home-based device as a means to offer a greater lifestyle opportunity.

4 A CRY OF JOY

4.1 TRUST THE PROCESS

This MRP proposal began with a research question on The Future of Design's Divergent Thinking, initial future-casting based on earlier readings and literature reviews pointed to a potential of generating new design thinking tools, an influence of virtual/augmented reality and other technologies. Navigating a sea of secondary information with an open and curious mindset allowed for various discoveries and connectors to form. A STEEPV lens allowed for a comprehensive sweep while sifting through signals and trends. A general plan with information continually feeding in required a level of flexibility to revisit, reposition and pivot accordingly in order to develop more rigorous work. From this, a deeper and more respectful intervention was realized whereby the impact of a creativity decline was greater than just the design industry. This MRP's research techniques allowed for change and a developing narrative to solidify. Techniques described allowed for others to join easily and genuinely contribute supportive content, ideas and resources to enable a level of co-creation. While 2x2's and the CLA were primary scenario generators, the Future Cones remained as a compass throughout, guiding ideas, logic and allowing radical thinking. Ultimately, a process which allowed for swimming in ambiguity and new territory ran its course with levels of learning touching on Respect, Relevance, Reciprocity and Responsibility described as the First Nation's Four Rs of Higher Learning. (Kirkness, 2001) Next, findings from the said scenario techniques are discussed in detail.

4.2 WHITE BOARD WORK

POST TREND ANALYSIS PART TWO:

As mentioned in chapter one, **four** of eight trends were selected as having the most influence on the direction of this research. With key points of implications and extrapolations for each, summarized below, various pairs of **2x2** matrices were arranged to generate plausible scenarios.

Ultimately, At Home With AI + Mindful Modern Minds were combined to produce four quadrants of possibilities. Similarly, Data Control Matters + In Small Doses were combined.

1. At Home With AI [STEEPV- Technological]:

Trend Summary: With what may be viewed as low level AI or Narrow AI, it is artificial intelligence applied to a single task such as a chatbot, virtual assistant or self-driving car. It is goal-oriented, designed to perform singular tasks such as facial recognition, speech recognition/voice assistants, or searching the internet. On a higher level, General AI, technology allows a machine to apply knowledge and skills in different contexts. This more closely resembles human intelligence by providing opportunities for self-learning and problem-solving, often referred to as Machine Learning (ML). 2017 was called the "Year of the Smart Home" with many smart appliances on the market able to communicate in a home network as Internet of Things (IoT) allowing for remote: climate control, home security, appliance/device control, playing music and answering people's questions. A next evolution (perhaps with greater AI development) might allow devices to adapt to our needs and goals by learning and working as an external brain, managing various aspects of our day-to-day lives.

Trend Description: In more detail, working as a system of probability which is based on data received, ML technology is, to some degree, able to make human-like decisions by utilizing feedback loops which enables "learning". By accurately sensing or being told its decisions are right or wrong it (ML technology) can modify the approach it takes in the future. The application of ML is merging into many areas of life ranging from physical robotics to virtual personal assistants and helping to guide and enhance everyday living. Technology consumers are "slowly and carefully" trusting these assistants with private information such as banking and purchases and also with their children. As an example, a robot named Milo provides a level of learning for children with autism: *"Milo taps the power of AI to teach children with autism spectrum disorder (ASD) better social and verbal skills in 39 U.S. states. Additional new research shows how using social robots at home with ASD kids can improve gaze behaviors, such as the ability to make eye contact with others. AI also helps educators better predict which young students might struggle with ADHD and other learning disabilities through machine learning (a type of AI). It pulls data from hundreds of schools to identify clusters of at-risk kids that did not match previous diagnostics or who had been overlooked."* (Kennedy, 2019)

Implications:

• As AI and ML technologies continue to evolve, consumers, organizations and institutions are carefully adopting new changes as they reason with the level of control in their activities and develop enough comfort with this technology augmentation in their lives

• A general understanding is that AI can save time, money and offer opportunities for individuals to enjoy a better quality or enhanced life as this technology continues to develop

• A future of personal experiences which are customized rather than relying on typical human gut feeling when making choices, AI can provide a systematic framework which is rational and logical, employing algorithms which deal with sophisticated analysis to help people make better decisions (for example: AI managed personal wardrobe collection to best suggest additions and outfit configurations given various seasons, moods, weather, activity and physical shapes/weights)

Extrapolations:

• AI might make people better off in the next decade, but many, understandably, have concerns about how advances in the technology will affect what it means to be human, to be productive and to exercise **free will**

• Experts express concerns over human agency, data abuse, job loss, dependence lock-in, criminal mayhem, **solution initiatives include**:

Global Good- Improve human collaboration across borders and stakeholder groups

Value Based- Develop policies to assure AI will be directed at ‘humanness’ and common good

Prioritizing People- Alter economic and political systems to better help "humans' race with the robots"

2. Mindful Modern Minds [STEEPV- Social]:

Trend Summary: Mindfulness meditation has long been associated with religion and spiritual traditions. Now, particularly in the West, the emphasis is on stress reduction, relaxation, reduced anxiety, less noise, finer focus and greater peace of mind. As technology moves us faster and fully wired, humans are discovering more than ever, there is a need to counterbalance, slow down and unplug. Mindfulness meditation is a mental training practice which teaches people to control racing thoughts, let go of negativity and calm both mind and body.

Trend Description: Mindfulness is a mode of awareness which involves the self-regulation of attention maintained on immediate experience with an orientation that is curious, inquiring, open, and accepting. Receptivity and acceptance with monitoring, rather than active efforts to reach a specific goal, characterize mindful awareness. Our fast-paced, western society has developed in recent years to a point of record level of anxiety, depression, reduced attention spans and other mental health challenges. Mindfulness has gone from being a buzzword to becoming a movement which has provided considerable mental health-related benefits and has also served as a tool to aid in creativity. Distraction is one of the greatest obstacles to cultivating creativity. The bottom line is that, in order to access more creativity, we need to find the silence within ourselves to create a space of allowing mindfulness to help provide that opportunity.

Implications:

• Rising stress and depression are fueling meditation and mindfulness (self-care) activities, humans are finding relief via digital options online

• Trend growth is all part of a skyrocketing, "anxiety economy" which has risen due to issues such as excessive smartphone use, 24-hour bad news cycles, unhealthy social media choices, climate change stress and now the COVID19 pandemic

• Improving mental health and wellness via self-help initiatives is an open topic in our modern society and gaining greater awareness with more online cooperation from social media (Annual Mental Health Awareness Month: 2020- #Tools2Thrive, 2019- #4Mind4Body, 2018- Fitness #4Mind4Body)

Extrapolations:

• self-care moves throughout the mind and body and carries over to one's environment, lifestyle design and personal ecosystem to include high quality sleep, super diets, quality education, calibrated exercise, decluttered spaces and taking care of the spirit via limiting negativity and avoiding unfulfilling work

3. Data Control Matters [STEEPV- Values]:

Trend Summary: The rise of data security, sharing breaches, fraudulent internet activity and massive amounts of personal data storage is alerting people to consider where their data is stored and who holds the control.

Trend Description: The popularity of cloud storage and web-based applications has steered consumers to trust various technology service providers to ensure people's stored data is safeguarded, accessible at anytime and anywhere from central computer servers. Accessibility has proven to be very reliable given a stable power grid, vast networks of wi-fi and a stable internet, however a slew of privacy and data breaches have surfaced. This has people wondering about exact locations of data servers, threats to this physical infrastructure and the absolute security of data to the trust of many people who work within the system.

Implications:

• Social media and users of the internet have enjoyed robust platforms for over two decades now and while many are content with the features of interaction and portals to receive the world's information, portions of the population are drawing a fine line between enough and too much

• Social media and daily internet use are a primary marketing engine while analyzing consumer purchasing and lifestyle activities+

Users realize the exchange of vital primary marketing data for connectivity but have a limit before they hand over their souls and are a target to be sold or stolen

• As a powerful medium for creative expression and sharing of sensitive information, the internet has seen its share of IP thieves and users are questioning the boundaries of data control

Extrapolations:

Alternate forms of secured connectivity are being developed constantly whether they be peer to peer or private networks. Applications such as Snapchat created a new ecosystem in 2017 which delivers an unusual new model where transmissions of information (text/photos/expressions) are sent only to disappear after a determined number of seconds. As new users join the internet every year, privacy concerns will only increase along with various forms of connectivity, encryption and transmission of information.

4. In Small Doses [STEEPV- Social]:

Trend Summary: Fast-paced life is seeing an availability of shorter, smaller, less intensive experiences while maintaining meaningful outcomes for the effort, time and expense invested. Ranging from yoga at one's office desk to meal-replacement-drinks, to tango lessons during a lunch hour or an oxygen blasted 20-minute snooze, societies are becoming comfortable with smaller doses of what once filled hours of our schedule and required days to plan

Trend Description: From products to services and experiences, more is being offered to individuals in the form of concentrated and combined configurations. Advancements in design, technology, manufacturing, health and research allow for a host of new possibilities in small packages. "Mini" has moved to "micro" with "zippy" shortenning to "zip" as consumers encourage and welcome more to fit into their busy lifestyles. Smaller and faster portions are fitting well into the time slots between work, play and home.

Implications:

• Individuals are embracing the fact they can enjoy "some" instead of "none" in their fast-paced lives

• Expectations continue to demand for quality and variety instead of quantity alone, whether it be food or clothing as examples responding to an overabundance (anti fast-fashion groups)

• A rewarding and experience filled life can be enjoyed and maintained through concentrated offerings available throughout the many different lifestyle types and journeys around the globe

Extrapolations:

• Digitization and AI can help to further alert and assist individuals' **access** and book short-term events and experiences as their routines, interests and schedules are "learned" by sophisticated applications

• Individuals can easily trade, share and recommend their micro events with others in a moment's notice

• Consumers are able to customize and fine-tune a given stretch of time to include a series of smaller experiences choregraphed into a small portion of time

2X2 #1: At Home With AI + Mindful Modern Minds

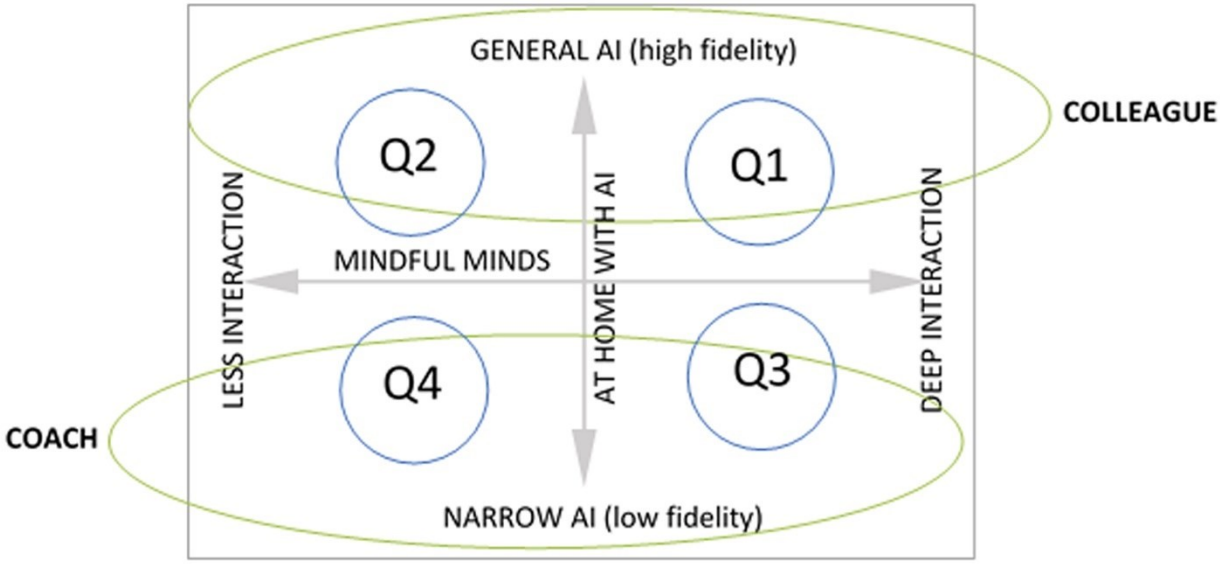


Fig. 28 2X2 scenario set with first two trends and Lubart's Creativity Partners

Critical uncertainties in this scenario set change to a degree of quality for human interaction with regard to **mindful thinking and concentration** juxtaposed with the range of **artificial intelligence/ machine learning technologies as low to high fidelity.** In a sense, two intelligences (computer and human) placed together to learn how forming environments for developing creativity might emerge.

Q1 + Q2: Generated lines of thought toward a deeper learning for both AI and user as ML requires ongoing education through dialogue to better deliver in future. Robust activity may take place--such as interfacing between AI and user's night-time or even lucid dream state along with a deeper level of empathy, emotion, creative inputs such as visual and audible samples from users may also occur. Creativity development in this environment potentially, or "*preposterously"* never paused with AI always working in background to later communicate with users. **Physical input hardware peripherals here may integrate as virtual reality/augmented reality/mixed reality and equipment and other input devices such as smart phones, digitizing tablets, audible and gesture motions.** AI suggestions and interactions enhancing creative work capable in this quadrant as machine learning contributions.

Q3+Q4: This quadrant reveals ideas contributing to less AI algorithmic power, however enough mindfulness to review and reflect on creative work, allow for planning and goal setting for future activity. It is within this environment where creativity and learning sessions might run while handsfree journaling, small deposits of thoughts or longer reflection. Facilitation of inspiration and inspiration and incubation may occur across the two quadrants. Interfacing hardware is interwoven for audible and listening with possible visualization projection (digital projectors, ceiling, wall, screen) as well as smartphones. **AI capabilities range from chatbots to sharing of information and activities developing with one's creative journey and learning.**

2X2 #2: Data Control Matters + In Small Doses

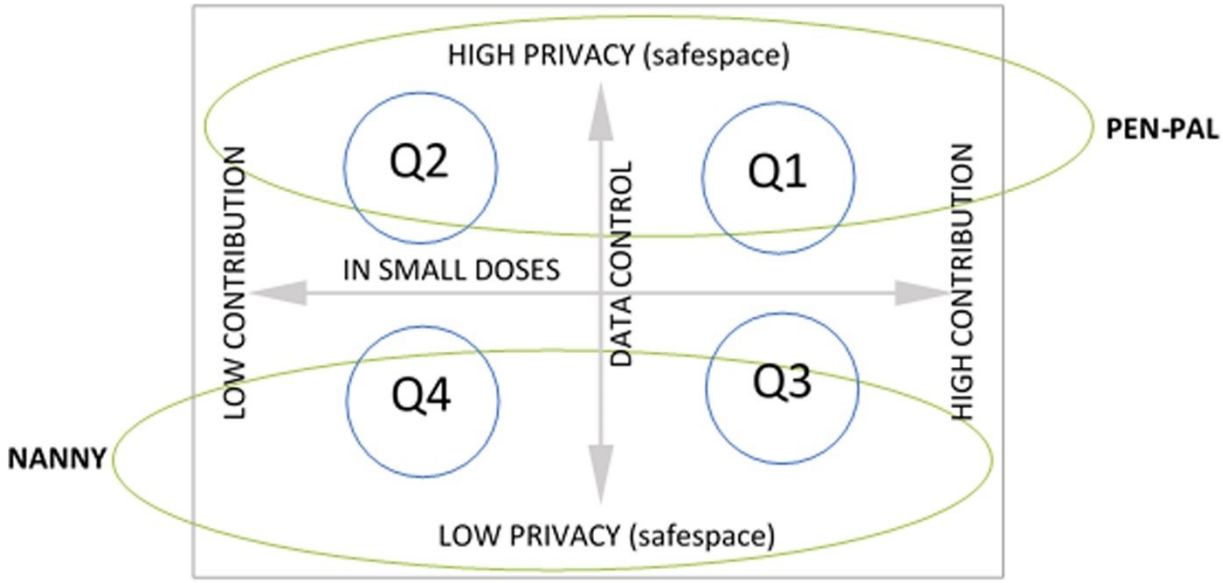


Fig. 29 2X2 scenario set with second two trends and Lubart's Creativity Partners

Critical uncertainties in this scenario set become one's **contribution** of time and effort to engage with creativity placed against the level of privacy (safe space) of information and/or activities.

Q1+Q2: In this environment, thought formations flowed in the direction of peer communication and collaboration with others suitable to share work, ideas and creative energies. An environment where experiments take place, failing is embraced and deep new exploration is achieved. Possible connectors to relevant social media channels and/or dedicated creative domain environments online

Q3+Q4: Here, non-AI activity takes place in the form of personal scheduling, reminders and relieving creative pressures and stress. Synchronizing with housing data storage is possible along with utilizing Internet of Things to execute as a creativity manager.

Interestingly enough, after much iteration and reflection of trend work and the four selections above to generate 2x2 work, **content developed evolutionary to that presented in Lubart's 2005 study** suggesting a future vision where people creatively co-exist with software and hardware to revolutionize computing and AI interfacing as a continued Colleague with tools to enhance creativity. A Coach, to develop creativity methods and techniques, a Pen-Pal acting as a communicator with others and a Nanny fostering creativity personal management-------ultimately updating Lubart's creativity partner to a future, ***Creativity Companion***. A companion which operates on levels best suited for the user via full customization of an AI platform capable of uniting robust technologies allowing for a **wide range of activities, interfacing, controlling data and supporting personal human creative development**.

4.3 Deliverable Remap For Children

While the above initial 2X2 scenario work allowed to conceptualize how AI and technology might incorporate into **adult daily activity** surrounding creative work and align with the notion of Lubart's framework of computers as partners, a remapping is detailed below for delivery within childrens' creative learning development as previously highlighted in this MRP. **Synthesizing Lubart's four partner camps with guidance from Dr. Kim on how to best support children and their creativity development,** a **refined research narrative is formed in this MRP**. Kim advises how an individual's "Creative Climate" or the environment they are in, especially as children, have varying levels of creative fostering, nurturing, inhabitation and discouragement. Within these Creative Climates, Kim explains how people develop creative attitudes which lead to creative thinking and summarizes her Climate-Attitude-Thinking (CAT) theory to say that we must first cultivate Creative Climates which nurture creative attitudes and enables creative thinking skills. (Kim, 2016) In her wonderful analogy of growing and gardens, Kim expresses how quality fruit is achieved by a special blend of Four Climates consisting of:

Sunshine Climates: Similar to trees growing toward sunshine, inspiration encouragement from role models is necessary to learn from and continue to grow with curiosity and fun. (Lubart's colleague suggestion aligns with this as a **collaborator** and influencer or possible heroes and heroines for children)

Storm Climates: As opposed to growing in a greenhouse, hearty fruit grown in a stormy climate endure challenges and, similarly, children require high enough expectations to develop passions as they overcome challenges and realize their version of expertise and discovering what they are good at and enjoy. (Lubart's coach suggestion aligns with this as an aid to teaching and failing techniques and methods to a young **learner**.)

Soil Climates: As in nutritious soil rich with various elements, children require different experiences and perspectives learned from other people as we know through cross pollination and collaboration which is known as classic recipe for innovation as most successful innovators have not operated alone. (This aligns with Lubart's nanny as a **data manager**, allowing for children's information to collect and combine properly with others)

Space Climate: Similar to trees being planted too closely, children require their own space to "extend their branches", grow to their maximum and have freedom to think differently and non-conform as they become themselves. (This aligns with Lubart's pen-pal suggestion as a **communicator** allowing children to properly communicate with those who will safely allow levels of freedom and encouragement)

With a plausible navigation and support system augmented by artificial intelligence in place acting as a creativity **Collaborator, Learner, Data Manager** and **Communicator,** this research deliverable outlines the start of an AI powered system design (software) packed to operate via physically designed devices as effective computer interaction solutions. In the quest for "more" as indicated in the product benchmarking 2x2 in figure 26 previously, this **MRP's deliverable becomes an opportunity to design and develop hardware and operating software in collaboration with further research as a phase two of this work and described more in chapter five**. As for the AI system making up the majority of this MRP's suggestion, design parameters would build out from what is indicated below as examples at this point and time:

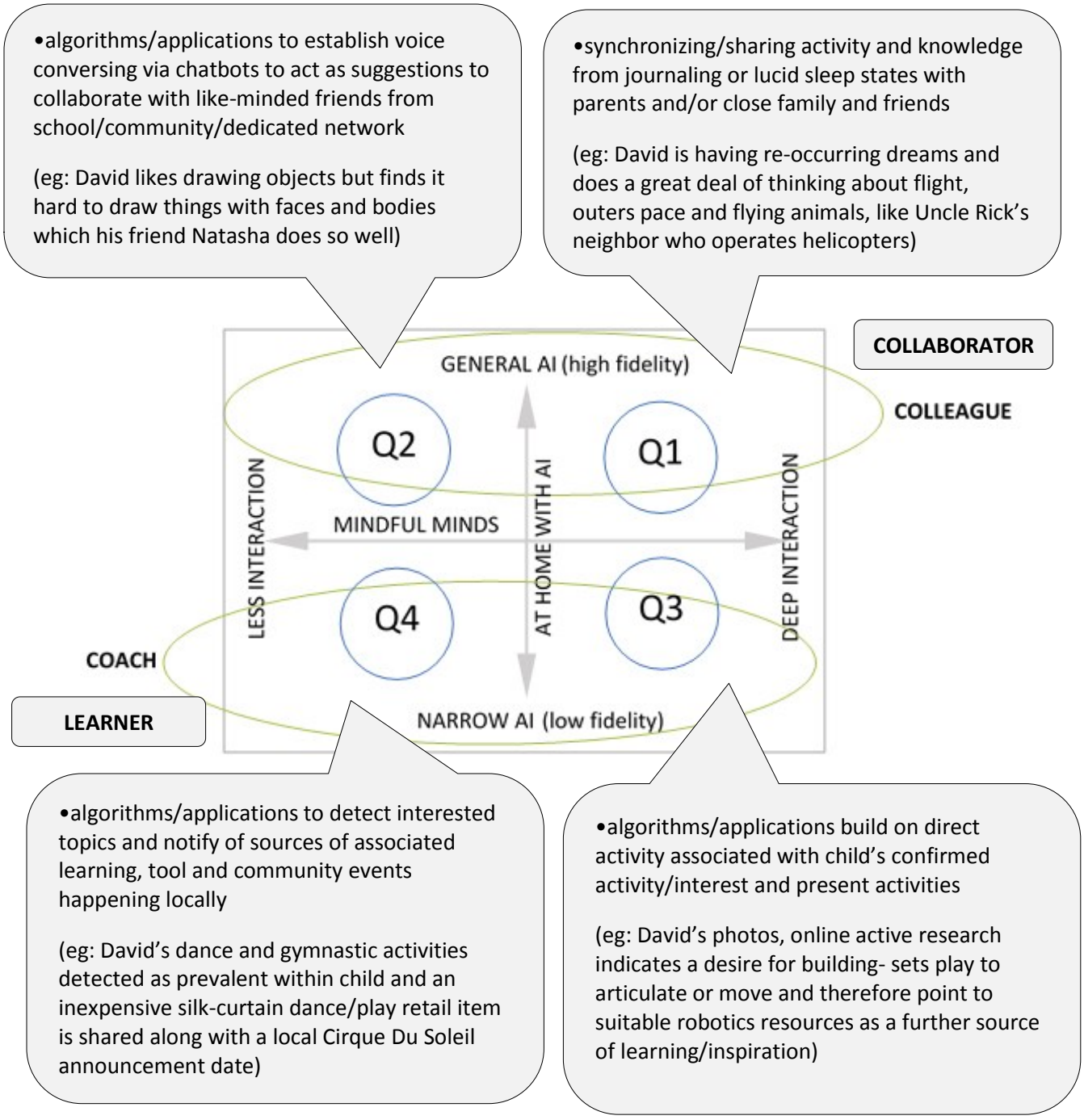


Fig. 30 AI and Mindfulness 2x2 scenario set evolved per **Creativity Partners for Children**

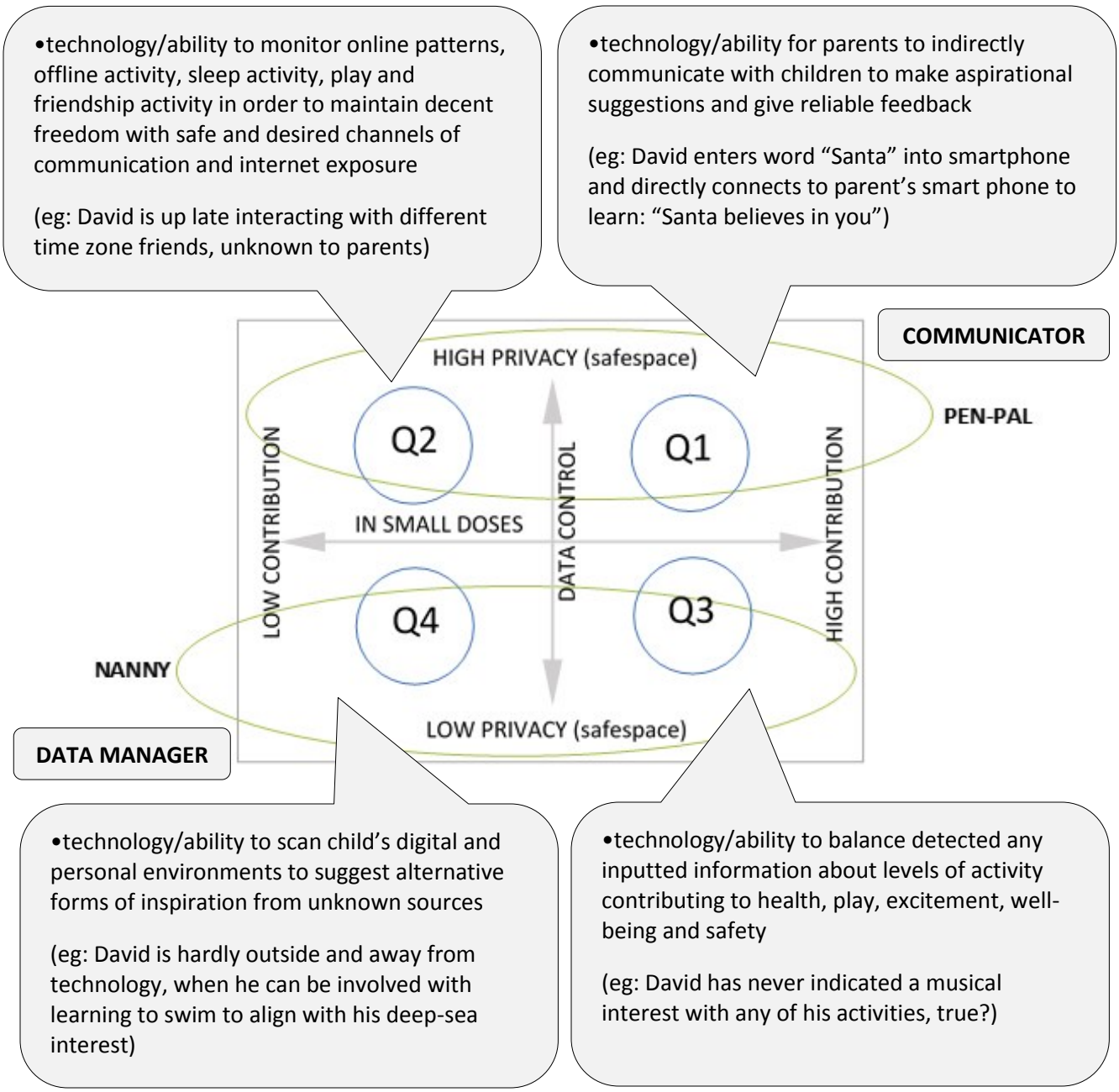


Fig. 31 Small Doses and Data Control 2x2 scenario set evolved per **Creativity Partners for Children**

Several journeys were taken through the CLA framework below. While the 2x2 scenarios work contributed to support a plausible future narrative of how people and computers may better work together to foster a balanced and creativity lifestyle, a sense of systemic and world views is not factored in. The CLA therefore was an appropriate next foresight step to further explore this future. Although eight trends were research through a STEEPV lens, the four contributing to the 2X2 work only included trends concerning Technological, Social and Values, making the CLA a supportive tool to potentially absorb Political and Economic input.

While there are many issues at play under the litany which have already been mentioned in this MRP, common challenges of being able to develop and maintain a lifelong creativity path is number one. With society, academia and non-supportive employment culture contributing most to systemic cause, these were placed as number two toward a dystopian descent. World views remained as stereotypical attitudes of the arts and design not deemed as important or valuable compared to enterprise, finance, science and engineering. Similar myths range from creativity as a readily available task online. Number five is in line with the aforementioned discussion on creativity not being device and technology dependent and is viewed as a critical human core ability not fully replicable by machines alone as we utopianly ascend to an AI fueled future. As a human skill and gift to be nurtured throughout one's life and contributing to society as an agent for change, creativity rises and stands tall with engineering, science, technology math---------- art and design (STEAMD/STEAM'D).

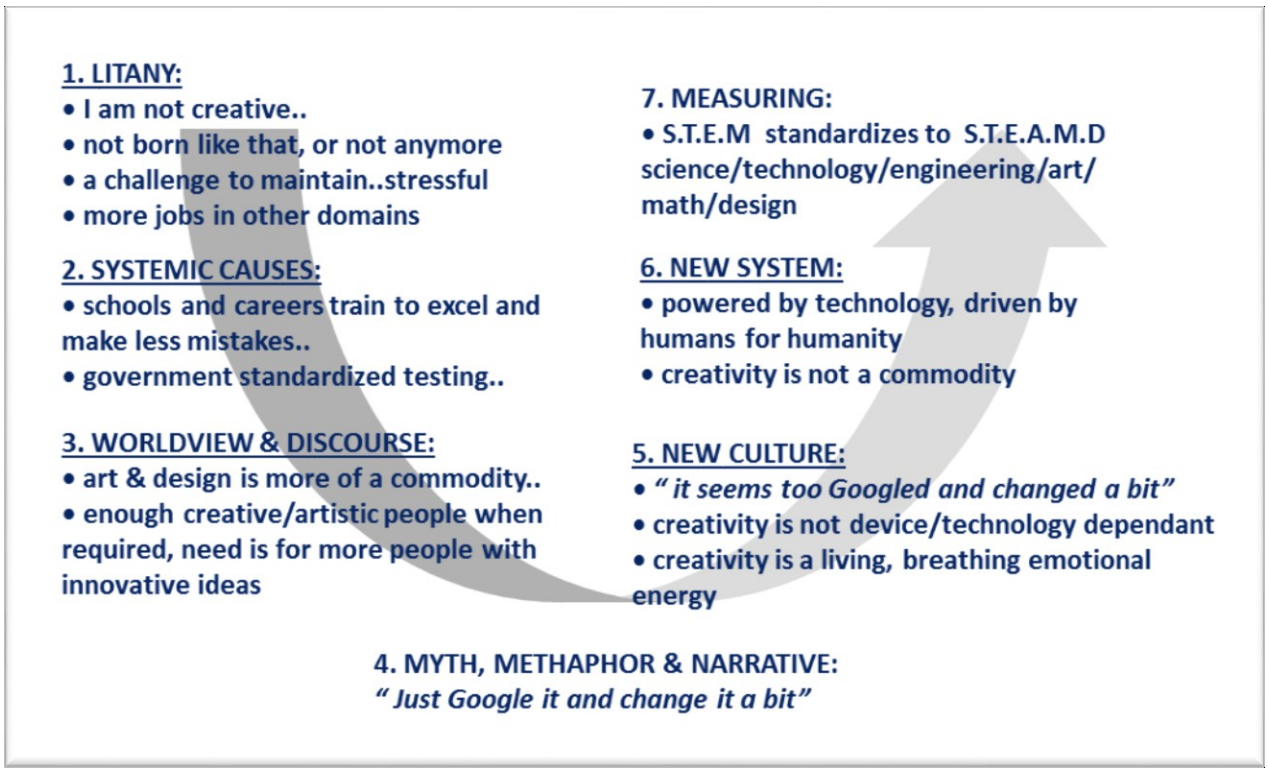


Fig. 32 Developed CLA framework model indicating creativity dystopian decline and utopian new future.

Deep insight and mental concepts from sensemaking and scenario frameworks for this MRP, remarkably assembled to fully bake into an aspirational vision to potentially dream a civic creativity incline within our communities. From this, a mission for an artificial intelligent charged design solution in the form of a physical artifact as a possible human interaction product is envisioned. While this research often referred to creative minds as children and adults, recalling 1990 data from KH Kim, begs the question of where to *physically* begin? Factoring in some mathematical sensemaking for the scope of this particular MRP work, points to several potential product design directions and demographics:

> **Launch Product Solution Demographic (children):**
>
> To recap and clarify, the Torrance Test score data published for 1990 logically represents test results from children in kindergarten through to high school (ages five plus) which is when standardized tests are administered. Looking at the kindergarten children here, who would have birthdates in 1985, are the demographic cohort known as Generation Y, otherwise known as Millennials. ("Millennials," 2020). Albeit early millennial births years are classified as 1980-1981 while ending births are from the mid-1990s-2000. ***In some aspect, early born Millennials could be considered making up the tail end of what might be defined as the most creative Torrance Test cohort in North America***, these particular individuals are now 39-40 years of age. Parents in this range today are the parents of the said Generation Alpha with birthdates of early-2010s and ending births of mid-2020s, making for children who are presently ten to 1 year old.

As a physical product designed with AI supported navigation to address creativity learning development, demographic profiles are considered to be children ages starting at **4 to 10 plus.**

4.4 SKETCHING ILLUMINATION

What are we looking at and where is our starting point, or inspiration? In chapter two, current AI fueled robots, devices and applications were introduced and viewed as possible, similar points of reference. From a consumer product benchmarking perspective, drawing on quantitative and qualitative design characteristics, initial questions begin with: What could an AI powered Creativity Companion be packaged like? Or more importantly, how ***should*** an AI powered Creativity Companion look, interface and operate like? Consumer product **semantics** refers to the study of symbolic qualities of manufactured forms in the context of their use and application of this knowledge to industrial design. (Krippendorff & Butter, 1984) Symbolic qualities, specifically refers to the psychological, social and cultural context of a product as opposed to considering only the physical and physiological functions of a product. According to Krippendorff and Butter, a product or object's form communicates three things: **A narrative about the object itself, something about the larger context of its use, and something about the user who interacts with and develops a conceptual connection.**

The mood board mentioned previously permitted a deep exploration into consumer products, electronics, devices, and extending to furniture, appliances, vehicles, nature and animals while absorbing material finishes, colours, textures and many visual and sensory languages. Through extensive sketching, many scenarios were visualized and contemplated. Referring back to two distinct product user demographics of users, it was decided to begin with primary conceptualizing for a youth model eventually followed by an adult model. For a youth model, inspiration was ultimately drawn from objects and experiences children have familiarity with, including technology children learn with, interface and currently live with on a daily level within a home environment.

Conceptual energies coalesced from 2X2 scenario work in combination with the many questions throughout this MRP in the method Warren Berger refers to as ***question-storming*** and propelled by an evolved futures cone (FC) to allow for utopian-preposterous-dreams. Freehand sketching began through a ***Preferable*** lens moving to a ***Utopian-Preposterous*** lens and periodically visiting all the cone points in between during a very fluid, random and iterative ideation exercise over multiple times. Below are samples of random pre-sketching question-storming and idea generations touching upon various FC categories.

Creativity Companion (CC) WHAT IF primer questions list:

• It could be **toy**-like for kids?	• An ability to **lay** in bed and communicate?
• A mobile **app** with AR/VR/MR headset?	• **Wake up** with and sleep?
• It's not a CC at all, but **disguised** as something else?	• **Bedside** device, speaker, player, screen?
• A CC without the CC as an obvious **intention?**	• Night table, wall, ceiling **mounted?**
• A computer application alone? Creativity **headquarters?**	• Lighting fixture, **night light**, night **charger?**
• Something **specific** for music, art, design, writing?	• **Wearable tech**, watch, watch-like?
• Something from Apple? Google or **NOT** at all **CLOUD?**	• Modem, wi-fi and blue tooth configured?
• A smaller internet----------an ***"Inner-net"?***	• **Digital storage** device + AI + CC? **Hard drive?**
• A **home-based** server like the "HELM" unit?	• Digital peripheral as a **projector** + speaker?
• A personal home based**, secure** cloud and CC?	• **Gaming console** and/or toy-like game + AI?
• AI + Home **Network** + IoT unit?	• **Interactive** wall screen, mirror? **Smart mirror?**
• **AI platform** online? Collecting data or personal 100%?	• Generic **décor item** as smart speaker?
• AI platform which is **opensource?** Shareable?	• **Art sculpture** piece + AI + modem + server?
• AI platform which via ML is specific to users (s)?	• Work **desk** artifact/organizer**/lamp/HEPA** fan?
• Opensource AI + media-center + secure IOT + device?	• Wall **clock**, furniture piece, **bedroom**/play rm?
• How about a **real companion** device? Clinical?	• Soft goods as blanket, pillow, wearable **comfort**?
• Smart speaker or smart other **"appliance"?**	• **Headphones + AI + Watch + Console?**
• A **pet** robot? mechanical? Another Jibo-like bot?	• **Tablet** + AI + IoT?

Fig. 33 "What IF" pre-sketching primer questions list for Question Storming exercise

Loaded with insight, scenarios in text form, driving logic from Verganti and Norman as well as Krippendorff and Butter, pen to paper proved to produce a number of design directions as depicted in the prior question-storming chart. As a first phase of sketching, several concept groups hovered around the ***Preferable to Plausible*** FC zones, in other words ideas which might be expected, obvious and likely without a high level of desirability. However, several sketched attempts seemed to, indeed, touch upon a table-top device resembling a smart speaker with a lamp function. This most resonated with a lamp on a work desk or even bedside table. Perhaps within a child's bedroom, study area or media center. While generating more concepts, sketching reached a point where a bedside or a bedroom table-top in close proximity to a bed was beginning to make a great deal of sense. As a common décor item with the practical purpose of illuminating space, ideas were explored around types of bedside lighting which initiated brief additional research into **wake-up lighting**. Often referred to as sunrise alarm clocks, several units are entering the market currently from brands such as Philips, Casper and HomeLabs. They are **positioned as lifestyle and wellness products providing a range of healthier options to wake up gently and peacefully, wind down before sleep and some models providing light and sound therapy to combat Seasonal Affective Disorder (SAD).** With this on an upward trend, for both adults and children, it was felt to be a valid **starting point.**

Fig. 34 Consumer market examples of wake-up lights in bedroom context

How might a lamp be a form of a Creativity Companion?

Several rounds of ideation looked at factoring in keywords/features highlighted from question-storming which made for a strong case. In fact, several design configurations illustrated that, positioned as a home base unit, similar to current and popular virtual assistants, a hybrid concept could work **more like a home-based server or wireless hard drive, also on the consumer rise,** potentially operating on a similar level to the Helm brand private email server reviewed in the Data Control Matters trend. As an alternative to free cloud-based services, the Helm and its owner have full control of data activity and internet exposure as this unit is home based with a security key.

Fig. 35 Helm personal internet home server device views in context, security key and as standalone unit

Given a sufficient product housing footprint size and familiar product positioning, an opportunity to address many requirements for a **Creativity Companion allowed for a smart lamp to emerge in this MRP.** As an industrial design task taking shape, it is clear to conceive that such a smart lamp could be ***Possible*** and successful. **Distinctly designed and stylized for a youth application, an AI powered hybrid personal communication-bot is foreseen with a combination of the following features and parameters:**

1. **Style:** Clean, minimal, sophisticated aesthetic for adults, more abstract or fun for a youth model

2. **Illumination**: Various lighting features, wake up/read/sleep and general space illumination, time projection, possible LCD, possible laser projection

3. **Base Housing:** Charging for smart peripherals (smart phone/smart watch)

4. **Internals:** Robust wireless hard drive and processor for AI/ML computing and communication

5. **IoT:** Controlled internet exposure, act as a personal home network server (“inner-net”) for children fully customized/calibrated by parents and child users to some degree

6. **Peripherals**: VR/AR/MR headsets, digital pads and other possible input and interfacing gear, blue tooth wall/ceiling projector

7. **Charging:** Charging dock for peripherals, possible for some storage, electrical cord tastefully placed

8. **Interfacing:** Gesture control sensitive camera, smartphone/smartwatch application, on board buttons LED and possible LCD

9. **Sound:** embedded speaker components/microphones for voice interfacing

10. **Software:** Safeguarded platform dedicated to unit’s AI capabilities for best practices as advised by child development professionals, programmable and ultimately configurable by parents

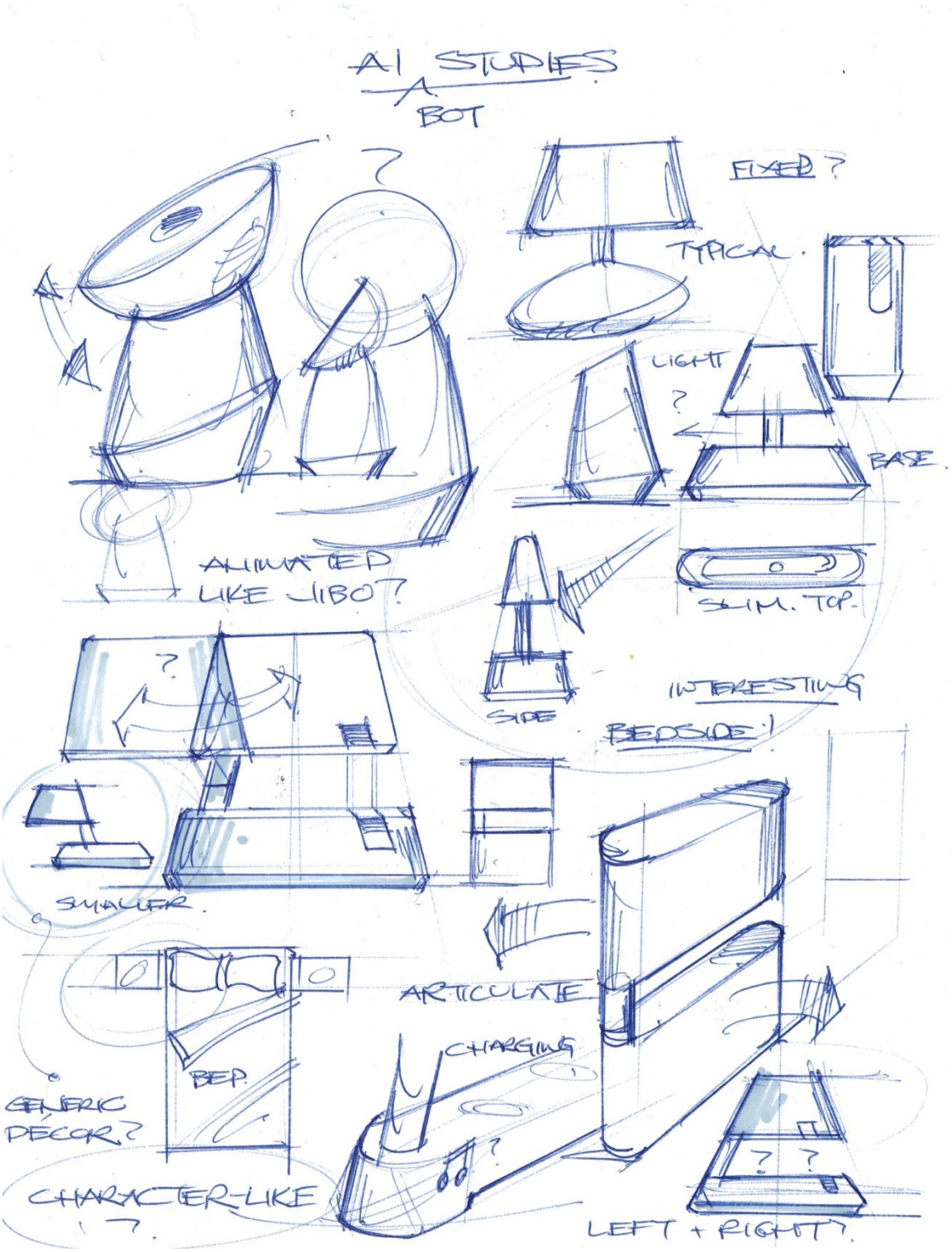


Fig. 36 Initial ideation sketching sample exploring for a possible Creativity Companion physical unit (children's' model)

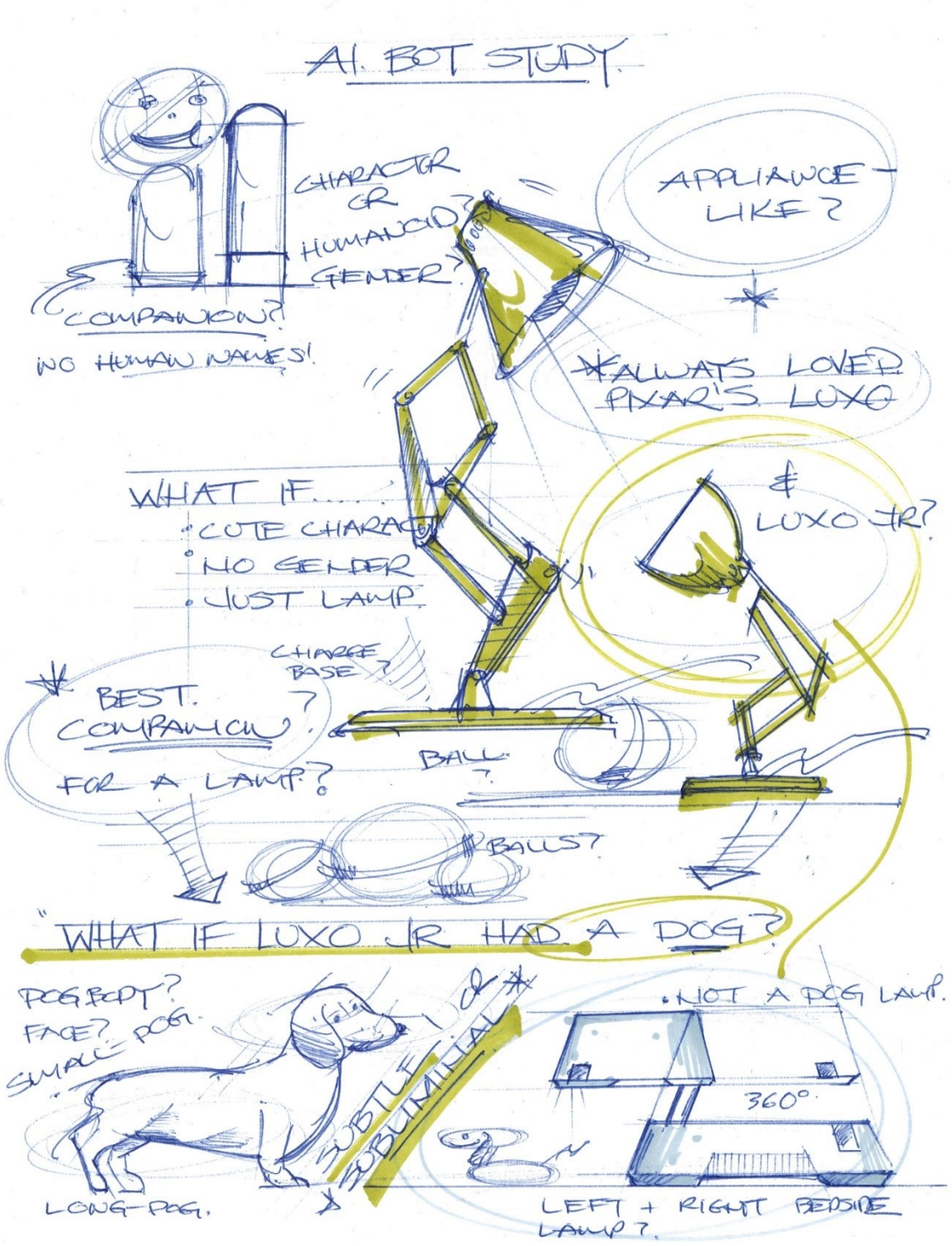


Fig. 37 Initial ideation sketching continued sample exploring for a possible Creativity Companion--physical unit inspired by preposterous/responsible dreaming (children's' model)

4.5 Out of Our Mind & Off Paper

As described in chapter three, a physical, prototypical design approach was decided upon in conjunction with the foresight methods covered in this project. As much as sensemaking work was beginning to crystalize with visual sketches helping to theorize possible futures, a range of low fidelity study models were produced. By way of preliminary three-dimensional (3D) computer assisted design (CAD) modelling and rapid prototyping or 3D printing, full scale study models were produced and their presence within home and lifestyle environments were assessed. This was an opportunity to gain a tangible visualization and simulate several experiential and interactive scenarios by placing models throughout a home's living quarters and specifically a child's bedroom environment where this study's trial concept is positioned. This learning by doing exercise revealed and confirmed opportunities for design iterations to improve product performance, living experience and aesthetic considerations. A glance of CAD modelling, 3D printed study and in context position trial photos below:

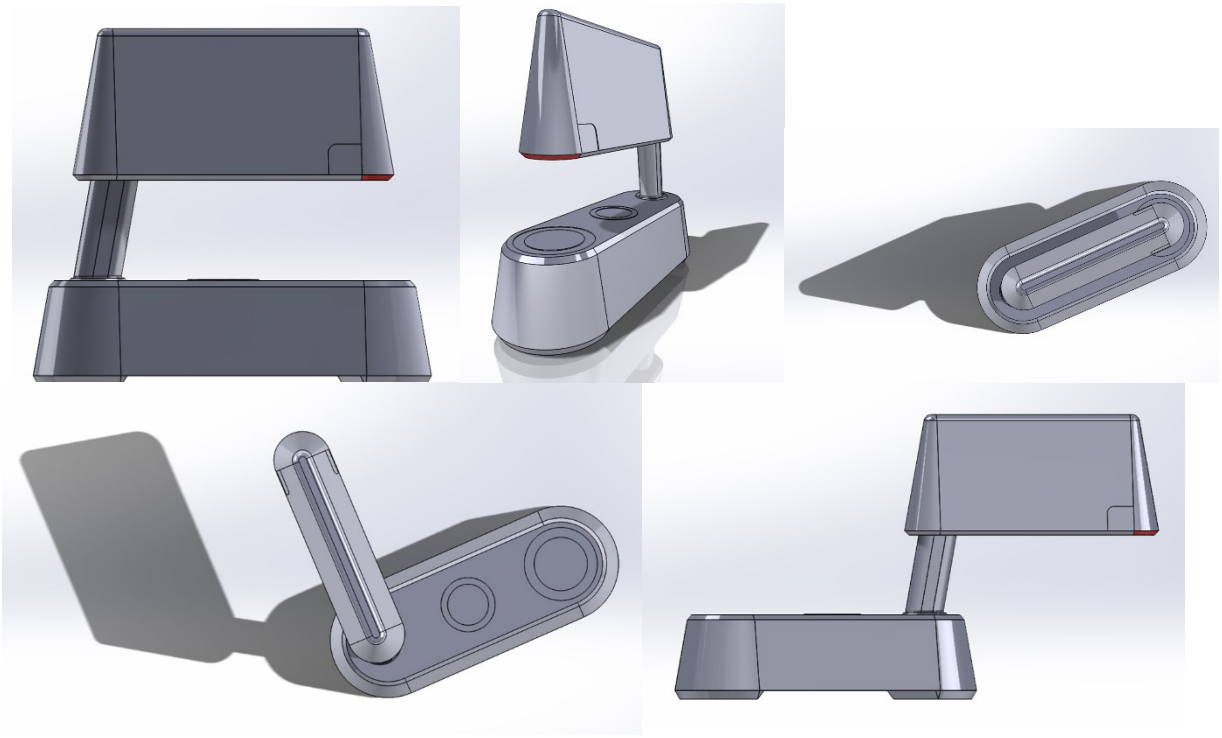


Fig. 38 Various 3D CAD geometry model views of preliminary design for 3D printed models: (from top left: front/three-quarter/top-collapsed/top-articulated/side-articulated)

Fig 39 3D printed sketch models in relation and in context with existing wake-up light.

Fig. 40 3D printed models along with found objects to simulate possible VR goggles and ceiling projection peripherals.

Fig. 41 Study model with smart phone and simulated smart watch charging and synchronizing with AI via Bluetooth and/or Wi-Fi

Fig. 42 Various in context bedside views with configurations of different peripherals including VR goggles, ceiling projector, smartphone and smartwatch

4.6 YŌŌˈRĒKƏ

At some point in the middle of this MRP, a **name was conjured up to help define the heart of this project as it relates to celebrating creativity, innovation and the wonderful freedom of our human spirit** to think differently and contribute positively to the world. It is believed that Archimedes has gone down in history (212 B.C.) as **the person who ran naked through the streets of Syracuse, Sicily shouting "Eureka**!" — or "I have it!" in Greek, as he discovered the principle of buoyancy during a bath one day. Also defined as “a cry of joy”, a non-human name was sought for this MRP to address the development of AI and its designers. The **phonetic spelling of eureka** seemed fitting as computer-like coding working with humans while recalling a time in history where solitude with thyself, deep creative thought, free of distraction, noise and enabling concentration was commonplace and **joyous.**

This MRP research question was answered by separation into three manageable portions to address individual complexities. It was felt that creativity required its own level of understanding in today's light and within **current generations and with current adults** in order to fully appreciate the challenges and issues. Through extensive literature reviews and engaging with structured expert interview questions along with semi-structured valuable dialogue, a deep understanding and realization was grasped. Outcomes of this pointed to understanding that the problem with the world of creativity is not so much creativity, rather the world or environments surrounding people to be creative. Society and communities have evolved to warp speed and levels of empathy, respect, patience, concentration, focus and appreciation are **deteriorating.** Systemic conditions adding to this in academia and in the workforce also continue to add layers of unsupportive contributions**.**

Second, was a deep dive to grasp a sense of where AI is traveling and how humans are attempting to live and work with it in their lives as an upcoming and somewhat unknown force. Through AI subject experts and secondary research content, a foundational knowledge was acquired to understand not only AI's applications and limitations but also to experience just how accessible and comprehensible information for a complex technology would be. Having been able to assemble a level of broad understanding of AI revealed distinct activities where AI was either being utilized to **enhance human creativity or automate societal creativity.** Literature review, case studies, foresight sensemaking and a sustainable lens provided an opportunity to leap forward as a respectable intervention into the creativity decline with a bold belief that we can harness the power of AI to activate and empower human creativity development rather than automate it.

Third, was an approach to tangibly applied research reasoning toward a consumer market opportunity as a product and service to contribute positive, societal change. This began as an early stage into industrial design practices by way of visually communicating sketched, creating 3D CAD geometry in order to produce 3D printed, full sized, study models.

Ultimately, for the purpose of presentation and to further build on a compelling narrative toward next steps, a more refined device below is envisioned. Moving forward includes expertise beyond the scope of this MRP. Additional participatory design input from children, parents, teachers and associated professionals would be required in order to begin work as phase two of this MRP. A phase two would fully construct Yo͞oˈrēkə's Artificial Intelligence supported operating system and look closer at which additional interactions, interfacing elements and hardware peripherals which might represent logical features and configurations of technology to support a young, creative learner. (Fig. 43-44)

Yo͞o'rēkə ™ Children's Bedside Wake-Up Light and Learning Companion

• Smart wake/sleep/reading

• Smart phone/watch recharging

• Smart speaker/voice interfacing

• Smart, **Yo͞o'rēkə*TM*** WIFI

• AI parental control system and router to configure digital learning network for children (home and away as IoT)

• Wireless hard drive & secure storage as personal cloud

• Signature **Yo͞o'rēkə*TM*** learning software which is configurable, adaptable and calibrated for child's creative development and lifestyle (see Fig 44)

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Fig. 43 Yooreke device design proposing features and operation as AI learning for creative youth

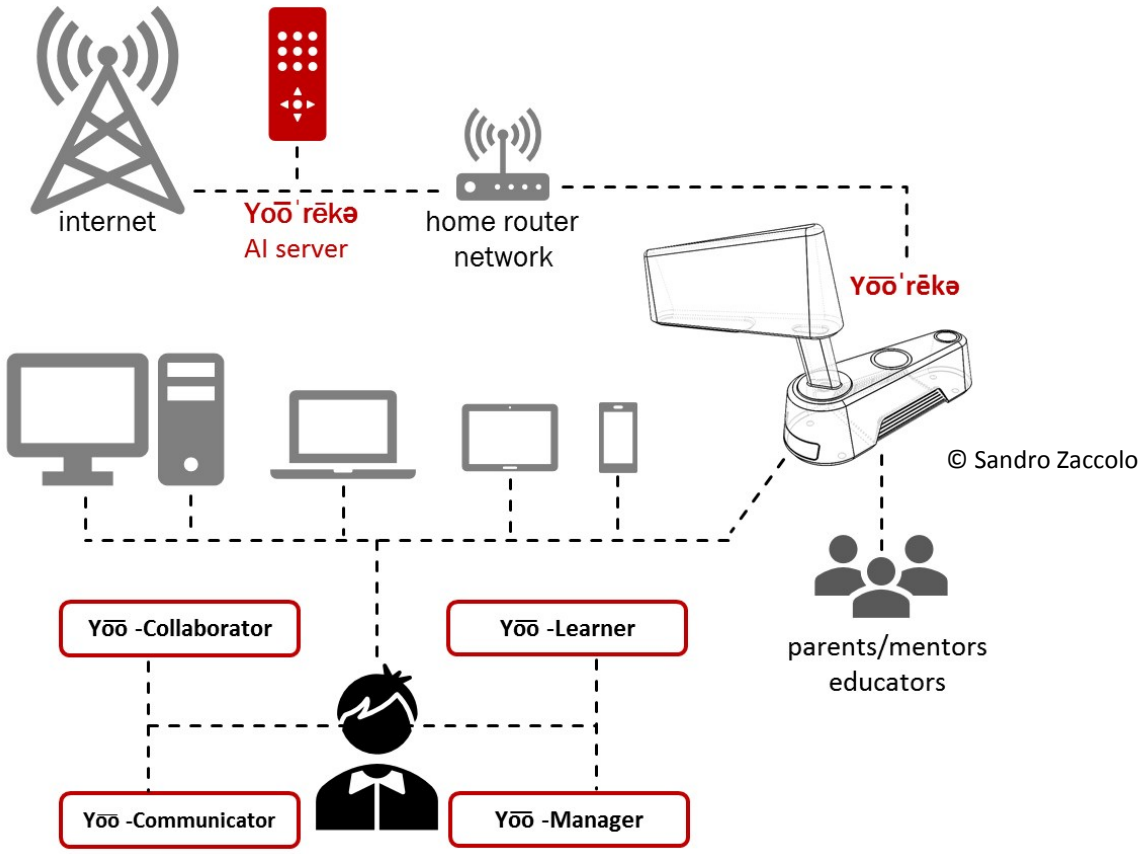

Fig. 44 Yooreke System configuration indicating main actors and components

4.7 CHAPTER FOUR SUMMARY

Much like processes of human creativity, this MRP's research methods, techniques and overall navigation required an open mind, a positive outlook, a range of tools to experiment with and most importantly------a safe place in order to discover, sift through complexities, co-create and fail forward. This process allowed for an opportunity to potentially arrive at a result which might not have been considered by others to continue this study's development and progress. This MRP work has reached the ground floor as the complexities of AI, ML algorithms and software design require an extensive and responsible development undertaking in order to present a suitable interfacing and logic center capable of achieving what **Yo͞oˈrēkə*™*** is proposing to deliver for children's creativity and associated early life development. Techniques and findings throughout this research detailed in chapter four were formulated trusting a foresight design process. This led to considering various scenarios which were derived from trend analysis work being mindfulness and developments within AI. Incorporating literature review insight along with information gathered through expert interviews on existing creativity environments and challenges was synthesized with Dr. Kim's research on creating a Four-S

Climate structure to provide for the best approach to establishing an effective, creativity filled childhood. In order to further innovation, utilizing AI as an assistant rather than simply automation equipment and tools, AI is viewed as a Creativity Companion to a child's creative and learning journey. As AI and its algorithms and technology applications in the form of software operate on computer systems and larger scale servers, a home-based intervention solution is envisioned as a medium to connect with children in ways which appropriately support and maintain best parenting and learning development practices balancing online and offline activity for young children. This medium has been conceived as a human computer interaction device within a home setting and positioned as a lifestyle product aimed at supporting parental control over an Internet of Things network to provide a contributing solution as described in the next chapter.

5 IT TAKES A VILLAGE

5.1 FLOURISHING GARDENS

In addition to the Four-S Climates, Kim shares a total of 27 attitudes. Each of the S Climates being the Soil, Sun, Space and Storm include key creativity supporting attitudes which range from: open-minded, bicultural, complexity-seeking, optimistic, spontaneous, energetic, self-efficacious, reflective, defiant and several others. Interestingly enough, Kim illustrates how each of these attitudes also carry a negative stigma not supported often in society which, essentially contributes to many of the challenges we endure as creative adults which this MRP's expert interview summaries align with. For example, Kim shares creative attitudes which often carry these unwanted side effects: (ie: wanted/unwanted)

Mentored/channeled, resourceful/opportunist, big-picture/dreamy, curious/annoying, spontaneous/impulsive, energetic-hyper, playful-mischievous, risk taking-reckless, independent-aloof, persistent-obsessive, uncertainty-accepting-fearless and many others in her book **The Creativity Challenge** as mentioned in this MRP introduction. With a direction to serve children as a priority with this research, these creative attitudes need to be fostered for children as technological competition continues with children and parents struggling to have families navigate a healthy path through the intricacies of complex future communities, evolving technology, internet networks and social media.

Increased globalization and connectedness have led to a more complex society which has multiplied the need for creative thinkers. Creativity can be taught and nurtured throughout childhood and adulthood by creating strong environments and systems which are necessary conditions to allow for Open-mindedness, Original Thinking, Emotional Expressiveness, Daydreaming, Nonconformity, Fluid Thinking and above all, Playfulness. (Kim, 2016)

5.2 AI AUGMENTATION

It is understandable how the above creative climates, wanted and unwanted attitudes above coupled with the tasks of a Creative Companion acting as a Data Manage/Learner/Collaborator/Communicator and factoring present day layers of internet chaos and societal pressure amount to a **massive navigation for children and adults** within their creative cores. Almost appearing as a tall order for even AI/ML there is certainly a high level of complexity here. And while it can be understood much easier as having AI automate this for us as a form of Artificial Creativity, it is not possible presently for machines to feel genuine emotions to heartfeltly laugh, cry from loss or experience culture, elements which have contributed to some of the most wonderful innovations and experiences of our time. Armed with insight from this research work a narrative for planning next steps is evident. As various forms of AI continue to develop and align with related technologies, it is believed through this MRP work that humans can embrace AI and apply it to our quests for a creative future as an assistive force (or as Milkos Philips suggests, Augmented Intelligence) where all may benefit, from the east to the west, children and adults. An assistive AI network which would grow and become something greater than what was purchased, and over time with parental/user calibration and support, become an invaluable assistant.

5.3 YO͞OˈRĒKƏ STRATEGY

Circling back to the innovation formula presented by IDEO in chapter one, which indicated desirability, feasibility and viability, this MRP work helps to establish Human Creativity as a desire and necessity for a flourishing future of change. Artificial Intelligence and its associated technology are ripe for societal augmentation given a responsible design plan presented in this work making for feasible executions.

As the famous African proverb: “It Takes A Village to Raise A Child”, this has inspired a strategy for this project to conclude with a viable implementation direction. While development of an AI opensource platform is conceivable and appropriate for this project as is the manufacturing of such a **Yo͞oˈrēkə** item, a plausible business model is presented in the final chapter.

Strategy is about making specific choices to win in the marketplace (Lafley & Martin, 2013). In their book, Playing to Win, Lafley and Martin share how according to Mike Porter, author of Competitive Strategy, which is the most respected source on strategy ever written, “a firm creates a sustainable competitive advantage over its rivals by deliberately choosing a set of activities to deliver unique value.” With that, it is this project’s focus to align with prioritizing a mission to implement:

AI for people and not AI over People.

As discussed in chapter three, Dunne & Raby indicate in Speculative Everything that, “in a consumer society, it is through buying goods that reality takes shape. The moment money is exchanged, a positive future becomes real. If it did not sell it would be sent back, becoming a rejected reality. In the consumer society, the moment we part with our money is the moment a little bit of reality is created”.

While an AI powered **Yo͞oˈrēkə** may certainly be a start--acting to serve up suggestions, reminders, alerts and seamlessly organizing one’s creative environment to hopefully suggest a walk or trip into nature, one deliverable is certainly not to encourage a growing negative side to Individualism. As a part of the trend research earlier in this MRP, a review of the rise of Individualism in North America was undertaken. Here, an understanding was reached to acknowledge an increasing desire for younger individuals to establish themselves as an “individual” in order to carve out their own unique identity, follow their dreams and be different. Appearing to be a part of A Millennial's DNA and driven by enhanced digitalization, Individualism, when extreme, can leave individuals isolated and vulnerable in their personal lives, often leading to a game which is not won in the long term and contributing to an alarming increased rate of a lack of empathy for others, a phenomenon already happening in the US. Noted in this MRP several times, collaboration, cross-pollinating and experiencing life out of yourself and within communities, marketplaces and supportive workplaces is ultimately, where creativity thrives, reaching change making visions with every contributing entity.

To expand on reaching for Creative Communities, this work is inspired by several Quadruple Bottom Line (QBL) focused corporations or B-Corporation often regarded as community of leaders who drive a communal or global movement of people using business as a force for good. As a QBL organization, this could represent Product, Profit, People and a fierce Purpose of fostering creativity. Referred to as a Value-Based Innovation Play, it allows products to stand for something and foster a movement in order to focus on a particular constituency, cause or reason for existing. (Keeley et al., 2013). In their book, Keeley and co-authors present the **Patagonia Corporation’s** vision that the company will “build the best product and cause no unnecessary harm”.

Borrowing a similar strategy and business model for Yo͞oˈrēkə, the exploration of a vision for a B-Corporation producing creativity fostering product lines with profits contributing to community-based makerspaces in the form of STEAMD ***CENTRES*** where not only makers are welcomed but individuals in STEM and all arts and design, including musicians, writers, entertainers and creative thinkers. A vision is set for every unique STEAMD CENTRE to form and arrange as it must to serve its surrounding neighbourhood and community. Profit portions feed locations with equipment, tools, knowledge and most of all, **an environment aligned with the precious Four Climates and 27 Attitudes** as described by Dr. Kim.

Strategy tactics include:

Product Performance FOCUS: Design products/services for a particular audience.
• manufacture creativity building products and services for various domains, youth to adults who: *CELEBRATE THEIR CREATIVE CORE*
• enable open-source software platforms which allow for secure use, customization and no data collection ability whatsoever
• supported by schools, organizations, creativity coaches and creative communities

Brand TRANSPARENCY: Let customers see into your operations and participate with your brand and offerings.
• opensource software platform is continuously improved via customer feedback and reoffered at no charge
• product design, line extensions customer input and partnerships with outside organizations are encouraged

Brand VALUES ALIGNMENT: Make your brand stand for a big idea or a set of values and express them consistently in all aspects of your company.
• Various community based ***STEAMD CENTRES*** located in libraries/community centres/schools/galleries/museums/presentation centres and idle workplace areas

Customer Engagement WHIMSY and PERSONALITY: Humanize your offering with small flourishes of on-brand, on-message ways of seeming alive.
• Yo͞oˈrēkə's own media application feed encourages blog to blog interaction and taps into supportive local creative communities to collaborate, communicate and celebrate STEAMD CENTRE projects and creative outcomes for specific region chapters.

5.4 CHAPTER FIVE SUMMARY

Fostering personal, long-term creativity is a lifelong endeavor. While supported at a young age, one frequently loses track with all that society delivers globally, as internet circles grow massively making it difficult to realize a baseline of creativity surrounding individual's own backyards. As much as AI may be for people and preserving creativity, STEAMD communities as a Creative Commons may have even more power and intelligence to unite likeminded creatives. **Enterprise and community have a strong ability to effect change** and align with visceral challenges and larger world issues. Having customers connecting to make up a brand's following leads to customer action, engagement and loyalty.

6 FINAL THOUGHTS

This research is merely on the ground level, while engaged with an early phase of a typical product design work methodology with regard to formulating a physical design solution. As for a responsible and humanized approach to design an artificial intelligence platform, this work is only scratching the surface as much more work is required to arrive at a point of greater clarity for implementation. It is a hope that this work contains a plausible narrative which may find its way to a possible future and begin the steps towards helping creativity thrive again as a paramount need to venture a more complex and uncertain next generation. If not for us now, then at least for our children.

This MRP was completed in December of 2020, during a resurgence of the COVID19 pandemic in Toronto, Canada and many parts of the world. It has been extremely challenging for everyone and while many have managed to adapt and find new ways of working and living, others have been observed to engage more with their creative cores, build better homes, spend more time with family, be a little less fearful of making mistakes and **releasing perfection** while the world is a mess. It has been a joy to see more children play outside, people notice nature again and retail stores selling out of building materials and flour as people make and bake. It is, however, incredibly sad to have these favourable outcomes arrive with the loss of so many lives. Many have been blessed with a chance, to reignite much in their lives of late and focus on what is important to help with what may very well become urgent. It has often been noted that, a lack of funds and a lack of means is more of a blessing than a curse, as nothing quite the same inspires ***creativity.***

Afterword:

Leonardo Da Vinci has forever been a hero of mine as he is for many others, including Bill Gates and Steve Jobs.

In Walter Isaacson's 2017 book, Leonardo Da Vinci, Isaacson shares how the starting point for its creation was not Leonardo's art masterpieces but his notebooks. Leonardo's mind is best revealed over seven thousand pages of scribbles, notes, mental leaps, calculations, sketches, and to-do-lists filling pages as he could not afford to waste paper. While Leonardo has been described as the most relentlessly curious and creative person in history, Leonardo has also been dubbed a **genius**. Isaacson writes, "Yes, he was a *genius*: wildly imaginative, passionately curious and creative across multiple disciplines. But we should be wary of that word. **Slapping the genius label on Leonardo oddly minimizes him by making it seem as if he were touched by lightning." "In fact, Leonardo's genius was a human one, wrought in his own will and ambition. It did not come from being the divine recipient, like Newton and Einstein, of a mind with so much processing power."** Leonardo had minimal schooling, could barely read Latin and had challenges doing long division. His genius is in fact understandable (as children and adults) and that which we may learn from as it was greatly based on skills. Skills we today

can aspire to, such as intense observation, fantasy-like-imagination and----------a drive for asking questions. While his notebooks displayed an array of wonderful sketches studying light, anatomy, nature and mechanics *(he curiously invented the exploded view drawing),* it also included a vast amount of the said "to-do-lists". One such notebook from 1490, in Milan, for one day's list of things he needs to learn: (Isaacson, 2017)

"The measurement of Milan and its suburbs? Draw Milan."

"Get the master of arithmetic to show you how to square a triangle"

"Ask Giannino the Bombardier about how the tower of Ferrara is walled"

"Ask Benedetto Protinari by what means they walk on ice in Flanders"

"Get a masters of hydraulics to tell you how to repair a lock, canal and mill"

"Get the measurement of the sun promised to me by Maestro Giovanni Francese"

"Observe the goose's foot, if it were open or always closed, it would not be able to make any kind of movement?"

"Why is the fish in the water swifter than the bird in the air since the water is thicker and heavier than air?"

"Inflate the lungs of a pig and observe whether they increase in length and in width, or only in width?

"Describe the tongue of the woodpecker"

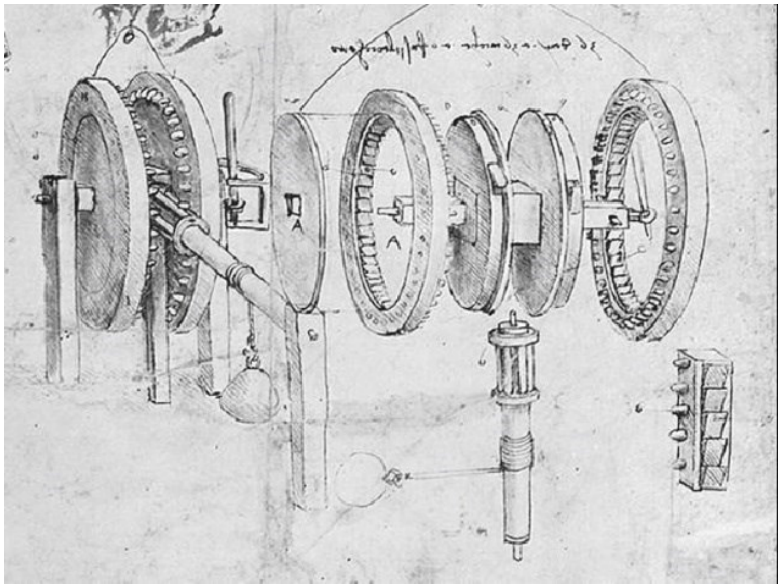

Fig. 45 Leonardo Da Vinci sketch of mechanical gears as an exploded assembly view

REFERENCES

Berger, W. (2014). *A More Beautiful Question: The Power of Inquiry to Spark Breakthrough Ideas*. Bloomsbury Publishing USA.

Carr, N. (2008, July 1). *Is Google Making Us Stupid?* The Atlantic. https://www.theatlantic.com/magazine/archive/2008/07/is-google-making-us-stupid/306868/

Charting the Challenge of Perfectionism. (2016, January 11). The Systems Thinker. https://thesystemsthinker.com/charting-the-challenge-of-perfectionism/

Condon, S. (2019). *Jeff Bezos' business advice: Think about what's not going to change*. https://www.zdnet.com/article/jeff-bezos-business-advice-think-about-whats-not-going-to-change/

Don't Let Perfection Be the Enemy of Productivity. (2020, March 3). *Harvard Business Review*. https://hbr.org/2020/03/dont-let-perfection-be-the-enemy-of-productivity

Dunne & Raby. (2013). Beyond Radical Design? In A. Dunne & F. Raby (Eds.), *Speculative everything: Design, fiction, and social dreaming* (pp. 1–10). The MIT Press. https://www.jstor.org/stable/j.ctt9qf7j7.5

ELIZA. (2020). In *Wikipedia*. https://en.wikipedia.org/w/index.php?title=ELIZA&oldid=986519946

Eric Maisel. (2020). In *Wikipedia*. https://en.wikipedia.org/w/index.php?title=Eric_Maisel&oldid=973557198

Gabora, L. (2017). *What creativity really is—And why schools need it*. The Conversation. http://theconversation.com/what-creativity-really-is-and-why-schools-need-it-81889

Isaacson, W. (2017). *Leonardo da Vinci*.

Keeley, L., Walters, H., Pikkel, R., & Quinn, B. (2013). *Ten Types of Innovation: The Discipline of Building Breakthroughs*. John Wiley & Sons.

Kennedy, L. P. (2019). *Childhood in the Age of Artificial Intelligence*. WebMD. https://www.webmd.com/parenting/features/childhood-artificial-intelligence-ai

Kim, K. H. (2016). *The Creativity Challenge: How We Can Recapture American Innovation*. Prometheus Books.

Kirkness, V. (2001). *First Nations and Higher Education*. http://www.ankn.uaf.edu/IEW/winhec/FourRs2ndEd.html

Klass, P., & M.D. (2019, May 20). Is 'Digital Addiction' a Real Threat to Kids? (Published 2019). *The New York Times*. https://www.nytimes.com/2019/05/20/well/family/is-digital-addiction-a-real-threat-to-kids.html

Krippendorff, K., & Butter, R. (1984). Product Semantics: Exploring the Symbolic Qualities of Form. *Innovation*, *3*(2), 4–9.

Kumar, V. (2012). *101 Design Methods: A Structured Approach for Driving Innovation in Your Organization*. John Wiley & Sons, Incorporated.

Lafley, A. G., & Martin, R. L. (2013). *Playing to Win: How Strategy Really Works*. Harvard Business Press.

Land, G., & Jarman, B. (1993). *Breakpoint and Beyond: Mastering the Future—Today*. HarperBusiness. https://books.google.ca/books?id=JQvzP8S6vEkC

Lubart, T. (2005). How Can Computers be Partners in the Creative Process: Classification and Commentary on the Special Issue. *International Journal of Human-Computer Studies*, *63*, 365–369. https://doi.org/10.1016/j.ijhcs.2005.04.002

Millennials. (2020). In *Wikipedia*. https://en.wikipedia.org/w/index.php?title=Millennials&oldid=989134179

Norman, D., & Verganti, R. (2014). Incremental and Radical Innovation: Design Research vs. Technology and Meaning Change. *Design Issues*, *30*, 78–96. https://doi.org/10.1162/DESI_a_00250

Philippe Starck, Kartell and Autodesk unveil “first production chair designed with artificial intelligence.” (2019, April 11). Dezeen. https://www.dezeen.com/2019/04/11/ai-chair-philippe-starck-kartell-autodesk-artificial-intelligence-video/

Philips, M. (2018). *The Present and Future of AI in Design (with Infographic)*. Toptal Design Blog. https://www.toptal.com/designers/product-design/infographic-ai-in-design

Secretariat, T. B. of C. (2018, November 22). *Responsible use of artificial intelligence (AI)*. Aem. https://www.canada.ca/en/government/system/digital-government/digital-government-innovations/responsible-use-ai.html

The Components and Psychological Study of Creativity. (n.d.). Verywell Mind. Retrieved November 4, 2020, from https://www.verywellmind.com/what-is-creativity-p2-3986725

The First AI-Generated Portrait Ever Sold at Auction Shatters Expectations, Fetching $432,500—43 Times Its Estimate. (2018, October 25). Artnet News. https://news.artnet.com/market/first-ever-artificial-intelligence-portrait-painting-sells-at-christies-1379902

Torrance Center for Creativity and Talent Development. (n.d.). Retrieved November 3, 2020, from /directory/torrance-center

Turing test. (2020). In *Wikipedia*. https://en.wikipedia.org/w/index.php?title=Turing_test&oldid=986039138

Voros, A. J. (2017, February 24). The Futures Cone, use and history. *The Voroscope*. https://thevoroscope.com/2017/02/24/the-futures-cone-use-and-history/

Wicked Problems: Problems Worth Solving—Wicked Problem. (n.d.). Retrieved November 4, 2020, from https://www.wickedproblems.com/1_wicked_problems.php

WIPO Report Validates Fears About U.S. Patent Decline. (2019, October 22). *IPWatchdog.Com | Patents & Patent Law*. https://www.ipwatchdog.com/2019/10/22/wipo-report-validates-fears-u-s-patent-decline/id=115239/

World Intellectual Property Indicators 2019. (n.d.). Retrieved November 3, 2020, from

https://www.wipo.int/publications/en/details.jsp?id=4464

Image References:

1. Retrieved From **(RF)**: https://www.researchgate.net/figure/Example-of-Torrance-Test-of-creative-thinking-14_fig1_305930963
2. **RF:** https://www.weforum.org/agenda/2020/10/top-10-work-skills-of-tomorrow-how-long-it-takes-to-learn-them/
3. **RF:** https://www.ideatovalue.com/crea/khkim/2017/04/creativity-crisis-getting-worse/
4. **RF:** http://dstudio.ubc.ca/research/toolkit/processes/
5. **RF:** https://en.wikipedia.org/wiki/ELIZA
6. **RF:** https://en.wikipedia.org/wiki/Turing_test
7. **RF:** https://news.artnet.com/market/first-ever-artificial-intelligence-portrait-painting-sells-at-christies-1379902
8. **RF:** https://thesystemsthinker.com/charting-the-challenge-of-perfectionism/
9. **RF:** https://www.dezeen.com/2019/04/11/ai-chair-philippe-starck-kartell-autodesk-artificial-intelligence-video/
10. **RF:** https://journal.studioaugustin.de/post/190511820363/bruce-mau-incomplete-manifesto-for-growth-via
11. **RF:** https://www.ubergizmo.com/2012/08/nikes-spike-pad-on-ossurs-flex-foot-cheetah-legs-used-in-the-london-olympics/
12. **RF:** https://www.internetnewsflash.com/openais-ai-powered-robot-hand-learned-to-solve-a-rubiks-cube/
13. **RF:** https://i.redd.it/tvrg7bbu3ej41.jpg
14. **RF:** https://www.softbankrobotics.com/emea/en
15. **RF:** https://www.youtube.com/watch?v=2017kmkEukE&list=PLslScf0UDB71T4yQqtCXCdviViNigDBap&index=89
16. **RF:** https://www.kickstarter.com/projects/1240047277/little-sophia-by-hanson-robotics
17. **RF:** https://www.millergroupmarketing.com/blog-post/artificial-intelligence-business-right-around-corner/
18. **RF:** https://www.wespeakiot.com/alexa-im-having-trouble-understanding-you-right-now/
19. **RF:** https://www.makeuseof.com/tag/play-game-life-goals-mindbloom/
20. **RF:** https://www.rocky.ai/digital-coach
21. **RF:** https://mdef.gitlab.io/2018/saira.raza/wa/week10/
22. **RF:** https://mdef.gitlab.io/2018/saira.raza/wa/week10/
23. **RF:** https://mdef.gitlab.io/2018/saira.raza/wa/week10/
24. **RF:** https://actionforesight.net/narrative-foresight/
25. Microsoft PowerPoint generated
26. Microsoft PowerPoint generated

27. **RF:** https://techcrunch.com/2017/03/08/parental-control-service-circle-with-disney-to-help-with-distracted-driving-social-media-kids-chores-more/ (fig 27: composition of several)
27. **RF:** https://techbuyz.co.ke/product/9632/?v=1990cf4a3bda
27. **RF:** https://meetcircle.com/
27. **RF:** https://robots.ieee.org/robots/qtrobot/
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31. Microsoft PowerPoint generated
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33. Microsoft Word generated
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34. **RF:** https://www.cnn.com/2018/04/05/cnn-underscored/wake-up-light-shop/index.html
34. **RF:** https://casper.com/ca/en/glow-light/
35. **RF:** https://theintercept.com/2019/04/30/helm-email-server / (fig.35 composition of several)
35. **RF:** https://arstechnica.com/gadgets/2018/12/review-helm-personal-server-gets-email-self-hosting-almost-exactly-right/
35. **RF:** https://www.dezeen.com/2018/11/07/helm-personal-server-new-deal-design-data-security/
36. Manual concept sketching S. Zaccolo
37. Manual concept sketching S. Zaccolo
38. Computer generated renderings S. Zaccolo
39. 3D printed model photos S. Zaccolo
40. 3D printed model photos S. Zaccolo
41. 3D printed model photos S. Zaccolo
42. 3D printed model photos S. Zaccolo
43. computer generated renderings S. Zaccolo
44. MS PowerPoint generated images S. Zaccolo
45. https://www.researchgate.net/figure/Leonardo-da-Vinci-Codex-Atlanticus-detail-fol-30v-8v-b_fig1_257314768

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APPENDIX

A- Expert Interview Analysis (Creativity Coaches #1 to #7):

Creativity Coach #1:

			Questions rational: Seeking to understand the barriers and supports present in fostering creativity while grasping key issues at play in areas of accessibility to information, as well as other influences which might be physcological, physical, technological and societal BARRIERS SUPPORTS
	Interview Question 1: Do you feel that there are many resources to help foster creativity for youth and adults?	Interview Question 2: The Internet: As the world's library in our pocket and connected to so many people, places and technologies, how is this helping creativity?	Interview Question 3: I think it can be said that we are all born creative and all have that ability, but is this something that indeed requires work to develop, on a dialy level? (10, 000 hrs rule?)
Experts Interviewed:	**Reply Notes:**	**Reply Notes:**	**Reply Notes:**
Creativity Coach #1	• there are, if you know what you're looking for • if you are interested in music, there's certainly lots of opportunities out there for young people and adults to get involved with music • if you're interested in just even innovation and **maker spaces and technology, those are showing up more in schools** • **incredible that we have a maker space that adults can go to and you'll have someone building things in a 3D printer and somebody else literally building a canoe in the same space** • if you know what you want, I think there's a lot out there. I think we're really lucky right now that the way •the way we do one thing is the way we do all things, so if we're creative in one area of our life, say in music, or art or whatever, in building or cooking, then I do believe that transfers over and then will be creative in another area, albeit engineering, teaching, medicine **– it's a transferable skill** • in a post COVID world, creativity is going to be the tonic that's really going to help people deal with some of the emptiness of the big changes that are happening because you have it at your disposal at all times, **it doesn't need to be a structured activity in your community you can just be creative sitting at home with what you have in your room right now, you have everything you need** • **If you don't know what that is then there's a real lack of places for people to go unless they're maybe going to counselling somewhere**	• **it's helping creativity in that we have all the information that we need at our finger tips** so we can have an experience in our life and want to understand how to express it creatively and we can go online and use the internet • **It's great and creativity is all about making connections so for people who are comfortable with that it can be a lot of fun**, to be able to take something from this internet site or this technology and to do a mashup and work with it • **it gets difficult is that it's overwhelming and there's almost too much choice** and so I don't know if I've found that people are actually looking to the internet at this time as a source of their creativity. • starting to shift as people are getting more comfortable with things like Zoom connections, taking online little workshops and things like that. • big shift over even the last 10 years how information has been visually shared with us. • **that need for approval and especially with social media and I have worked with some people who had done paintings and put them on social media and had a major meltdown when they weren't loved**, What kind of artist am I? So, **it can be triggering, like a crisis, for sure.** • **many complexities with creativity because it is such a personal thing and it is in a way that we're expressing how we see and interact with the world and sharing it with others**. So, **you really**	• have to be intentional about it, **it's like mindfulness , think creative practice is similar to mindfulness,** you've got to keep a commitment to show up or **if you don't have time you can be creative just in how you drive to work and notice things and make connections in your head – it doesn't always have to be a product.** • **It can shine through in your relationships and the gifts that you give people and through the work that you're doing.** • **it's developing the process of being able to have a sense of playfulness in everything that you do.** •Being able to ask questions and to focus on that level of curiosity and the inquiry of life •**Creativity is about making something and then doing something with it**. Bringing something to life out of that and that thing that you bring to life might be a really great conversation with your kid, where you tell them a story that teaches them a lesson and everything but that's creative • **People have an interesting relationship with word creativity, It wasn't really until they started studying psychology, they didn't even start using it the way we use it today.** ***It kind of stresses them out, just the word***
Creativity Coach#1 Summary Notes	**Researcher Comments:** **Overall, a positive outlook on the amount of accessible resources available if one has a sense of what their domain has available. If they are lost, perhaps the counselling option will help.**	**Researcher Comments:** **- helpful with a lot of information at our fingertips** **- a great connector and communicator,fun!** **- overwhelming and almost too large with too much choice to get side tracked** **- can be triggering and problematic for those more vulnerable to crtisism**	**Researcher Comments:** **- have to be committed, it's work and a mindset** **- sense of playfulness and eventually sharing in with others** **- the notion of creativity can be streesful for some, a pressure to perform or produce**

	Interview Question 4: What do you think are the most important elements to facilitate or support creativity? For example.. thinking safe spaces, functional mediums to express thoughts, or the ability to process negative feedback, or others?	Interview Question 5: Generally, what do you find is helping people most today? What would be 3 top recommendations or rules to keep our creativity alive?
Experts Interviewed:	**Reply Notes:**	**Reply Notes:**
Creativity Coach #1	• there are--first you need to have some energy, **there needs to be a little bit of fire** • **But then also within the energy you want to have sustainability,** because we've all had great ideas •energy is really important and figuring out a way to ground your idea and energy so that you can see it through to the end •routines, environment, **there's the mental conditions you need to have, you need to be able to put yourself aside sometimes to be able to create and get out of your own way** •**creative connections, so being able to transfer your skill and talents from other areas into what it is that you're doing** •the productivity, what's coming in versus what's coming out and that right balance between choosing what you're going to allow to move into that idea. •Creativity is all about relationship. If you're working on a team to bring something innovative into the world, **you need to have that sense of play, you need that sense of safety** • **People need to be able to vulnerable to share ideas without fear of losing their dignity**	• **one of them is using the natural world as a model. I found that to work really well. If you use nature as a 3rd point,** and you have them look at and it use questioning to talk about even just selecting **different animals and what we can learn about them and recognizing through that learning as a 3rd point what they can inspire and teach us. I found that a very useful, helpful entry point for people who are anxious or nervous about creativity** • **Creativity is about looking and noticing. just by having them start by choosing a tree nearby that they pass and just watch that tree every day** and see how it changes, see who lives there and just notice the tree and the simple act of doing that can really open you up to seeing things in a new way over time •**Number 2 is play. Wherever you want to play, play with your children, somebody else's if they allow.** Going to a toy store and looking at toys you remember from your childhood, **getting together with friends, although that's harder, and do board games** • Number 3 would be saying yes. use to teach drama and there was a game we use to play where each person takes turns saying yes. **often as adults we get use to saying no and we become very critical and judgmental or ourselves and what we're doing and of other people. by saying yes to an idea that pops up or an impulse around something you want to, or somebody invites you to do something that you normally wouldn't do and you say yes to that** •Create the sense of openness that we need in order to be creative
	• **need to be able to trust that the people around you are going to take care with what you've decided to give to them**	
Creativity Coach#1 Summary Notes	**Researcher Comments:** **- drive and fire is needed** **- balance also required** **- sense of play and safety required, and trusting of the people around you**	**Researcher Comments:** **- exposure to natural envornment and all it entails to reduce anxieties and inspire** **- being aware, present and open to new experiences** **- play and being less critical of each other**

Creativity Coach #2:

	Interview Question 1: Do you feel that there are many resources to help foster creativity for youth and adults?	Interview Question 2: The Internet: As the world's library in our pocket and connected to so many people, places and technologies, how is this helping creativity?	Interview Question 3: I think it can be said that we are all born creative and all have that ability, but is this something that indeed requires work to develop, on a dialy level? (10, 000 hrs rule?)
Experts Interviewed:	**Reply Notes:**	**Reply Notes:**	**Reply Notes:**
Creativity Coach #2	• **Not a lot. But I think a few tools could help** • It depends on knowledge and it's **more efficient for adults to get the creative knowledge** • **it's difficult for children in school, they learn how to study in a line, A-B-C-D. When every part is independent, and in the "efficient people" video, they talk about how we should learn to study like mind mapping with all the ideas in the same** line and we do the length and if we want to learn in this way, we have to do the length and we have to refer what we think and we are interesting • **The big obstacle is the school, usually, because not all schools have the same system but usually it's a system where excellence and competition, you have to do things in the first step, perfectly – as the way we think you have to do this** •**You have to resolve problems the same way they want them solved and you don't have to use your own mental ability** •It's difficult but we can explain the process, maybe we don't have the same creative process, I think we don't - but just be conscious about our process and the way the phase preparation comes after you've identified what you want to do and what's important to solve for you • **In Quebec: schools we have a lot of after-school activities where we have a lot of arts, sports; we have a program that brings artists into schools to teach the students how they write a book**	• It's useful because we can share information but also, we have to have other scale or group that refers to the good tools for creativity and I don't think the internet is – it's too large • We have so many books since 2000 which refer to how to improve creativity, how to be more creative, or how to be as creative as the president of the Cirque du Soleil. •For many creative economies. people write a book and explain how to be creative in the business. •Guy Laliberté of Cirque du Soleil has a huge sense of creativity – he's by himself; a free mind • C2Montreal is a big event in business creativity, it's interesting – I'm not sure it's helpful for creativity, I'm sure it's good for business • The internet is too large – simply to find what you want to find and be sure that the reference you have is good, it depends what you want • if you want to see how they do things on the other side of the world that's good, but if you want to find real tools to help you to understand your creativity, to be more conscious about your own potential or creativity, It's difficult to find a good thing. •I'm not sure creativity is about new things, I'm closer to a good adaptation of a thing or problem. Adaptation like translation - something that converts English, is something that fits my real needs, adaptation makes more sense; it's difficult to be new in	• you have to show up, it's the creative process, the ideas, it's the main point of the creative process • there are physical activities, trying things, having projects, they're all training you. •all people are creative, but the difference is the training between people. Some people train themselves because they feel they need it, some people are more far from creative person because of the way they think they are. But in the situation of a problem, they will find a way I'm sure. Maybe it's going to harder to go that way
#2: Summary Notes	**Researcher Comments:** **- easier for adults but not children to access creativvity tool** **- school generally makes it tough to have creative thinking happen all the time because of the linear thinking or linear education process** **- the afterschool activities are great for this as it is free time without pressure, constraints and hard expectations**	**Researcher Comments:** **- great to share and communicate with this tool** **- many books on creativity since 2000** **- business tends to write books on being creative in business, each domain obviously tailors material for their field** **- internet is too large, your tools should be in line with your potential**	**Researcher Comments:** **- it's work and effort, can't be lazy or simply wait for it to arrive** **- doing is learning and learning is training**

	Interview Question 4: What do you think are the most important elements to facilitate or support creativity? For example.. thinking safe spaces, functional mediums to express thoughts, or the ability to process negative feedback, or others?	Interview Question 5: Generally, what do you find is helping people most today? What would be 3 top recommendations or rules to keep our creativity alive?
Experts Interviewed:	**Reply Notes:**	**Reply Notes:**
Creativity Coach #2	• **Thinking safe spaces – the culture around you**; what kind of people and values around you • **the need of the society for creativity, but it's all about the relationships, the human climate. You put in place the way you listen to people** •**Consciousness of your access process. What brings your creativity?** What can interact creativity for you to be good factor and the bad factor for creativity for human in general but for you too to get your consciousness of the way you create. •**all the art medium or living way medium – cooking, a mechanic tinkering. In this activity you find your process, you find a way your ideas come**, the way you go over the right you have about creativity, in those activities you feel a good motivation - you feel good. You are in contact with your creativity. • **It feels good when you go into school or work because you refer to those processes (routines)** • **a good tool for me is those activities that you don't do for your living, you don't do it for your career, but it's good for you when you play piano for yourself.** When you play piano, you are in touch with your creativity. •We have a lot of French authors that do the creative journal, you probably read about those books- they teach you how to do a journal of your creativity. **Say every day you write - it's good. But it's not just about the writing, it's also about you having to train**	• Doing something – being active • When you coach someone you give them activities, things to do. Sometimes they receive it and say okay I'm going to do it because you asked me to do it, but it shouldn't be this way. It's the way we usually react though • Be active, do something, produce something • **Be kind with yourself. It's not going to be good; it's not going to perfect; it's going to be whatever – it's going to be something. You're going to make progress so be good to yourself.** Be very good with the results because with the results we judge so much, we judge before we get the result, we complain about ourself. It's education! • Be good with other people. Don't judge. Don't say it's beautiful, don't say it isn't beautiful. Don't say anything. Because if you always criticize the projects of others – it's good, it's not good, it's not for me – you train yourself to judge yourself • We need to get away from all judgements
#2: Summary Notes	**Researcher Comments:** **- creativity is a humane condition** **- safe spaces include culture and people/society that is supportive and kind to one another** **- routine at work/school help to drive creative priorities** **- non high tech activities like journalling are helpful**	**Researcher Comments:** **- actively engaged , doing, creating** **- steering away from being judgmental of yourself and others**

Creativity Coach #3:

	Interview Question 1: Do you feel that there are many resources to help foster creativity for youth and adults?	Interview Question 2: The Internet: As the world's library in our pocket and connected to so many people, places and technologies, how is this helping creativity?	Interview Question 3: I think it can be said that we are all born creative and all have that ability, but is this something that indeed requires work to develop, on a dialy level? (10, 000 hrs rule?)
Experts Interviewed:	**Reply Notes:**	**Reply Notes:**	**Reply Notes:**
Creativity Coach #3	• Yes, at the moment with COVID restrictions, they're hugely reduced. •There's far more thinking about how creativity works and there's far more resources for people going into art school to do a course. •There are far more resources than there were for children in the growing up in the 60s and 70s. •A lot of people loved teaching when they started who grew to hate it because there was soulless opportunities to encourage children to do the things that they were excited by, that they felt creative doing while making sure they were producing something that would bring good marks. •Us teachers were always trying to push the students towards open ended experiments. •You've got to have room to fail. For example, I teach in year one now and last year generally speaking, a whole year's work could be marked as one which means we can say there's loads of room to fail.	• On one side there is the being overwhelmed by too much information and so convergent thinking is needed in the selection of what you're actually going to take, evaluating is more left brain, isn't it – this is good, this isn't so good. •There's so much poor quality on the internet but there is also a lot of good quality stuff and finding your way through it requires certain strengths that not everybody has, some people do have it – some people know what they want, they're know what they're looking for and they know how to find it! •It's hard to get that balance between really valuing the richness and choice or just being unwell and not being able to digest anything. •With secondary research, in a way you have to get 1 of 2 things, you've got to digest it right into your system; take them in and allow them to become part of you, so when they become through, they become transformed into something new.	• Yes, there can be an overemphasis on productivity at times, so that creativity and productivity get confused by a lot of people. •Magical things happen when you're creative, when you go into that zone and that sense of flow it feels like you're meeting magic and then if you take too much time away you can start to idealize that. •I've seen that a lot with people who've stopped and their desperate to start back again but they've forgotten how boring it can be and how frustrating and what it's like meeting that resistance and the friction of things not working. •They forget about that bit and they want to come back to the magic so there can be the idealization and that goes with the fear of the creative process, and if you keep going regularly you get past that by that was today but there's always tomorrow.
#3 Summary Notes:	**Researcher Comments:** • there are a decent amount of resources, however, youth are more interested with getting good grade as more of a priority • more room to fail is required,	**Researcher Comments:** • there is a lot happening on internet, too much! • too overwhelming and a lot of poor quality mixed in with decent quality	**Researcher Comments:** • many forget how important it is • often there is an overemphasis on productivity or creativity

	Interview Question 4: What do you think are the most important elements to facilitate or support creativity? For example.. thinking safe spaces, functional mediums to express thoughts, or the ability to process negative feedback, or others?	Interview Question 5: Generally, what do you find is helping people most today? What would be 3 top recommendations or rules to keep our creativity alive?
Experts Interviewed:	**Reply Notes:**	**Reply Notes:**
Creativity Coach #3	• The freedom to take risks and to fail. •To try things and make mistakes and be okay with failure and to process failure as very normal part of the process, and a very useful part of the learning process. Safe spaces can support this. •How we process negative feedback can be make or break because if you get too much negative feedback but making mistakes, if you take that on board, that feeling of the capacity to take the risks is gone. •Whether you're getting it wrong, whether you're paying more attention to internal feedback or external feedback, it's that somehow to make it okay to be able to try things.	• Trying to identify intrinsic motivation, what do you love doing so much that you want to keep doing it until you're exhausted. •To identify rules that you would like to break. •And the sentiment is, we give this to students and sometimes they ask if they've got to break this rule, they're quite comfortable in, but if they really hate the idea of breaking that rule – hold on to it. Find one that makes you want to play outside of, the ones that you would have fun breaking. •Acknowledging this kind of not self, that part of where creativity is from beyond the ego because it requires a certain amount of relaxing and surrendering in order to sustain it. •If you try to hard you trip over yourself. In order to be creative you're trying to get to that part of yourself that's bigger than the little – this me, this is who I am, this what I'm showing off – that little ego self.
#3 Summary Notes:	**Researcher Comments:** • safe palces can help with people to fail • a strong ability to process negative feedback is key • need to be okay to try things	**Researcher Comments:** • finding what you love to do is easy if given the chance • if relaxed enough, creativity stands a chance otherwise one may trip over themeselves

Creativity Couch #4:

	Interview Question 1: Do you feel that there are many resources to help foster creativity for youth and adults?	Interview Question 2: The Internet: As the world's library in our pocket and connected to so many people, places and technologies, how is this helping creativity?	Interview Question 3: I think it can be said that we are all born creative and all have that ability, but is this something that indeed requires work to develop, on a dialy level? (10, 000 hrs rule?)
Experts Interviewed:	**Reply Notes:**	**Reply Notes:**	**Reply Notes:**
Creativity Coach #4	• In my experience, there are so many resources everywhere, there is so much to choose from but actually for one thing I can speak both as a coach and as a teacher and I can see both sides of the coin let's say. in the school system most of the time it's based on curriculum and standardized testing •So, the children and people in general, they learn just because they know they have to undertake those tests and exams. Their creativity is stunted because of this, they have a lot of creativity but they are not encouraged to bring it forth, in school for example. •Also, they are often told that creativity doesn't pay, creativity is not that important. Now we are seeing that this is changing a lot, it has been changing for some time. •Whenever we solve a problem, we are using our creativity - whatever field. And we underline that when we work with children, or old people, or even in coaching of course – it's all about creativity.	•It is, but the problem is at the very base is that people are not encouraged to think critically and in an unoriginal way and that's why despite having so many resources that no generation ever had, so many people cannot think on their own feet and cannot be original and creative because again we just trust whatever source we get but we are in a hurry to get information, information is everywhere. •So many people just google up something and that's it. The data is great but that's not the use we are supposed to be making of it. •At the same time, of course everything has been done at a certain level but not another level. Everything is different because the person doing it is different, nobody can do exactly the same thing as another one. So, I don't believe that – it's complicated.	•No, it's a practical skill as much as an intellectual skill, it's all about being curious and it's being perceptive enough to allow whatever is coming to you at that very moment and also taking risks with what you get. •Creativity has to do with being very open and being very playful. And also developing the discipline of playing seriously. •Many people take themselves so seriously that if they fail at something they are really, they feel down and defeated and that's exactly what we should address. •It's a mindset, there has to be a calm. We have to go beyond that if we want to achieve something on a societal level, a communal level, if we want to become a more creative society as a whole, we have to change this kind of mindset. •Of course, you have to practice, but I don't want to give the impression that it is a bunch of drills or whatever you do in an automatic manner, it's not that to me.
#4 Summary Notes:	**Researcher Comments:** • there are a lot of resurces, but that is not the issue • creativity stunned because of standardized testing • creativity is about solving problems, every field	**Researcher Comments:** • a lot of resources, problem is people are not encouraged to think critically • people Google for data incorrectly to aid in creativity	**Researcher Comments:** • people take themselves too seriously when they fail • a more calm mindset requied •practice is useful but not have to be a strenuous chore • need to be curious and perceptive enough to handle all that comes

	Interview Question 4: What do you think are the most important elements to facilitate or support creativity? For example.. thinking safe spaces, functional mediums to express thoughts, or the ability to process negative feedback, or others?	Interview Question 5: Generally, what do you find is helping people most today? What would be 3 top recommendations or rules to keep our creativity alive?
Experts Interviewed:	**Reply Notes:**	**Reply Notes:**
Creativity Coach #4	•Support. •When we are little it is important to give a lot of trust and belief to children, to young people. They have to develop a sort of resiliency – a sort of resourcefulness that they can deal with odds and they can solve problems in their own ways. That there is no standard answer. •Throughout life try to keep that mindset of being open to failure, to risk, to playing. Also, to discipline. But at the same time being playful all the time helps a lot. •Of course, being in nature helps a lot by helping us perceive beauty and patterns that are beautiful and that excite our interest and imagination. •At the same time, it's also about offering a sort of container. A container where people can feel, whatever happens this is not going to be the end of whatever I'm undertaking – a place to experiment. Where to be true and authentic and overcoming fear, it's important to offer that kind of support.	•I don't know if this exists, but what about some sort of artificial intelligence device that helps you with brainstorming. •The problem with dreams is that you have that 5-year-old, and maybe you remember it when you are dreaming but then as soon as you wake up and you try to write down or try to remember or whatever, linear thinking gets in and you lose a lot of it. •What I was thinking about is that when you try to translate what you saw in your dream, what you lived in your dream into language it's very hard because language is different.
#4 Summary Notes:	**Researcher Comments:** • important to instill resilience at early age with children • being in nature helps, also the power of play • container/safe palce required where people can be authentic and able to overcome fear	**Researcher Comments:** • artificail inteligence help if possible • dreaming in sleep is helful if you can recall and translate it ito something of good sense

Creativity Coach #5:

	Interview Question 1: Do you feel that there are many resources to help foster creativity for youth and adults?	Interview Question 2: The Internet: As the world's library in our pocket and connected to so many people, places and technologies, how is this helping creativity?	Interview Question 3: I think it can be said that we are all born creative and all have that ability, but is this something that indeed requires work to develop, on a dialy level? (10, 000 hrs rule?)
Experts Interviewed:	**Reply Notes:**	**Reply Notes:**	**Reply Notes:**
Creativity Coach #5	**There are certainly more than what there was before, we are seeing more creative resources out there.** It depends on what it is you're wanting to do and therefore what are the resources that are going to enable you or help you to do whatever it is you want to do. Of course, there are the things at the Creativity Association you can go into a course, you can look online, you can have a creativity coach, **there's loads of books** **if you look up creativity there's thousands and thousands of references around creativity.** There's so much there, there's so much material. **Part of the process is to actually curate from that and know what it is you need or what.** If it's yourself then you're gathering information and processing and synthesizing it for yourself or if you're an organization then you have to task somebody with that, **this is where there's the individual expression and creativity and then there's organizational creativity.**	Yeah, I definitely think it is. In fact, for me I found this time to be incredibly creative being online, all the workshops I've done in the past have all been basically face to face **Probably what we've got now is this incredible opportunity to be using technology in incredibly creative ways that are really helpful and enable us and also too that we would if we own technology** a lot then we need to also ensure that we are engaging with the natural world too – going out having walks, noting the sky, the animals; nature. We need to be careful that we don't allow originality getting the way of allowing ourselves to continue to do the work that we do and express it in the best possible way that we can with what we have at hand. This is the thing we need to understand, we are unique. Yes, we have common threads that run through us as human beings but we also have a very unique way of being in the world that is formulated in a range of ways, by experience, skills, culture, family and all of those sorts of things. **We need to be careful that we don't allow originality getting the way of allowing ourselves to continue to do the work that we do and express it in the best possible way that we can with what we have at hand.**	You have to attend to it. Part of that is thinking and doing. It's actually thinking about yourself as a creative being and then actually doing things. **You actually have to, there are times when you actually have to do – it's in the doing, it's part of our learning as well. There's nothing wrong with thinking, it's a wonderful thing and maybe more people need to do it, in fact. But if you want something to come to life, you can think about it all you like but until eventually you have to do something.** With my book here, I could think about it all I like but at some point in time, I had to put it into action otherwise it would just stay in my head and never come to life. And that's okay too, if I can say, it's alright; it can live in my head. But it depends on the skills that you have, you might not be able to sew; you could sketch, you can think, you can vision, you can drape some fabric but ultimately somebody else is going to have to take that creation and make it work on a body.
#5 Summary Notes	**Researcher Comments:** **• a lot of resources but YOU need to curate what YOU need or want** **• persoanl creativity and organizational creativity**	**Researcher Comments:** **• striving for originallity cannot get in the way of creativity all the time** **• techology is at at fantastic level to allow for creativity to flourish**	**Researcher Comments:** **• have to atend to it, get busy and make things happen** **• cannot fall into trap of thinking only, nothing will come to life in the same way**

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Experts Interviewed:	**Reply Notes:**	**Reply Notes:**
Creativity Coach #5	I could write and talk about nature forever because nature is our absolute go-to for inspiration; it is providing us with constant feedback and ways of thinking and being that if we're open to it and spend time with it, we actually start to see the world in a very different way. The whole biomimicry/biophilia world is particularly interesting from a design perspective; do you know the work of Edward O. Wilson; he was the originator of biophilia and how our relationship with the natural world is fundamental to how we can think about and design our environments. **I'm aware that art is not for everybody. We need to mindful that art is not the only vehicle by which we can be creative so really, it's about opening ourselves up to recognizing our creativity can manifest in all kinds of way.** If you think about law, it's very performative in many respects. There's a whole performance aspect to law and to be able to weave those stories and tell those stories and gather that information in ways that's compelling – that is creative.	It comes down to what is the creativity for? It's getting clearer about that beyond that naturally creative anyways, so allow yourself to have that self-conversation. There's a conversation that needs to go on with yourself to actually understand that you are a creative being, that you're capable of many things. The choices and the decisions that you make, where you focus your energy and all of that. Unless you're prepared to disrupt, there's a disruption that is with creativity as well. We need to learn how to disrupt ourselves, and organizations need to get comfortable with disrupting themselves and levels of uncertainty. You need to build in, particularly an organizational life is that recognizing that failure is the learning that goes on and when we talked about what we learn from prototyping, it's the same as in organizations. You have to build that in those levels of risk taking – not in a reckless way of the fear; but actually, recognizing that that's going to emerge like you're on the verge of something new, something different and not knowing whether it's going to work but the state of doing something different.
#5 Summary Notes	**Researcher Comments:** **• inspiration----from nature and natural world** **• not only tied to art, many can be creative in non-artistic ways**	**Researcher Comments:** **• conversations with yourself on the topic are easy and need to be had** **• easy to become complacent, need to learn how to disrupt yourself**

Creativity Coach #6:

	Interview Question 1: Do you feel that there are many resources to help foster creativity for youth and adults?	Interview Question 2: The Internet: As the world's library in our pocket and connected to so many people, places and technologies, how is this helping creativity?	Interview Question 3: I think it can be said that we are all born creative and all have that ability, but is this something that indeed requires work to develop, on a dialy level? (10, 000 hrs rule?)
Experts Interviewed:	**Reply Notes:**	**Reply Notes:**	**Reply Notes:**
Creativity Coach #6	especially after a certain age, young children, yes, I would say there is that direction in a school setting – talking pre-k and very young ages - there's a lot of classes that do want to incorporate, bring other teachers in the school, incorporate art and music and movement. But when someone starts to be in high school or young adulthood, there is a trend of almost having to fight extra for it to continue pursue classes, opportunities, funds, grants. It is something that people have to carve their own path to get there then let's say as opposed to more mainstream, easily accessible resources where someone would let's say graduate high school and then right away feel like they had a list of art related courses or schools or opportunities they had to do. They have to kind of follow their own. Especially in New York, for the people who are committed to go down a path of a creative profession or into the arts – there are the resources. For someone who is not committed in that sense, to say I've made up my mind I want to be a musician or a writer. It's not something that's easily in the persons palette of things that they would encounter and do.	SO over time is the effect you're describing, the fact that pretty much anyone with limited resources – you don't need to have very expensive technology or an agent to promote yourself – in that sense the fact that there is the opportunity for more ideas for more of that, whatever is going on in the person's brain that divergent thinking. The difference is if someone is looking at things in the short term, how things affect me and the people immediately around me or the long term; the accumulative effect. So that's one example where **I think the internet does help. Also, the fact that someone knows they can promote themselves and show immediately what they are creating, can have a motivating effect.** But it can be motivating to know that easily what I write, the music I compose can be easily accessible and easily exposed to others and with the feedback and the likes, with the sharing it can be motivating and it can make people want to do more work.	For example, when we talk about what motivates creative expression and why sometimes when people with a history of trauma might be more drawn to expressive art is because whether someone has experience or put work into it **there's something about the emotional need to express oneself through a visual through a painting, through the strumming of a guitar as a way to express emotions.** If that's the goal, work would help or course, in that it would hone their ability to do more. But it may not be a prerequisite. **There's a limit to what you can achieve without putting work into it.** Yes, I would agree, that someone assuming has a highly creative need for expression and already a talent, whether it's creativity in the technological or artistic creativity, work will take it a step further.
#6 Summary Notes:	**Researcher Comments:** **•at early ages in school, yes** **• highschool becomes more challenging as pursuit of other classes, opportunities, funds/work, grants, etc** **•certain popular domains like music, have the resources**	**Researcher Comments:** **• internet can be rich with support as it is free to promote** **• long term, exposure can have an accumulative effect to influence and inspire** **• self promotion can be motivating and allow people to do more of what they are doing creatively**	**Researcher Comments:** **• emotional need to express oneself and there fore some work in doing that is required** **• work would certainly hone their ability**

	Interview Question 4: What do you think are the most important elements to facilitate or support creativity? For example.. thinking safe spaces, functional mediums to express thoughts, or the ability to process negative feedback, or others?	Interview Question 5: Generally, what do you find is helping people most today? What would be 3 top recommendations or rules to keep our creativity alive?
Experts Interviewed:	**Reply Notes:**	**Reply Notes:**
Creativity Coach #6	The first thing that comes to mind, is towards the end of what you said because it already came to my mind is more of a cultural attitude thing, which is harder to do. **It's a cultural/societal attitude of creating space for more ideas without a right or wrong expectation.** for them to be able to feel comfortable to hone onto their creativity, they have to feel that they're not going to be ridiculed that they're not going to thought of as eccentric or weird. They're not going to told that they're like the mad genius or starving artist. There's got to be a cultural acceptance on a bigger level that starts with people's awareness at a young age that it's okay to be different, it's okay to have a wide range of self Collaborating with other people, that's very important. Finding groups and collaborating and being part of, even though people dread those very often, part of the reason they dread it is that element of approval, they dread saying something in a brainstorming group that might be considered stupid or something like that.	Showing up and being consistent and having some kind of schedule. It doesn't have to be by the hour but some tentative idea of in the morning, evening, some part of the day that you do what you do. I really believe in that, and that's across all domains, across all kinds of creativity – **having some kind of tentative routine.** Working on recognizing the self-doubts and the inner critics that are there and already see the foresee the problems down the line, like why would I take my camera and start filming who am I going to show this to? Or no one is going to like it, or not having the equipment to edit it down the line – so already seeing the problems, the criticisms that will inevitably then of course discourage you and halt any creative effort. A journal about thoughts and ideas, expressions, impressions, experiences, ambitions, goals, brainstorming – getting it out of the head and onto something you can see it makes it easier to do something about it **bonus comment: Now, the way that AI is as we know it, Alexa, Siri, all the great tools of google, images, advertising showing us things that we want, all that kind of stuff as scary as it can be, it tends to be a tool for creative people to use to their advantage.
#6 Summary Notes:	**Researcher Comments:** **• having a cultural attitude can help but without it becomes more challenging** **• critically negative and harmful feedback does not create a supportive environment and almost traumatic** **• society not always accepting of art, creativity, change, new ideas**	**Researcher Comments:** **• having a general routine helps** **• extinguishing seld-doubt and be more confident, foresee problems** **• journalling, getting out of your head to feel lighter**

Creativity Coach #7:

	Interview Question 1: Do you feel that there are many resources to help foster creativity for youth and adults?	Interview Question 2: The Internet: As the world's library in our pocket and connected to so many people, places and technologies, how is this helping creativity?	Interview Question 3: I think it can be said that we are all born creative and all have that ability, but is this something that indeed requires work to develop, on a dialy level? (10, 000 hrs rule?)
Experts Interviewed:	**Reply Notes:**	**Reply Notes:**	**Reply Notes:**
Creativity Coach #7	Yeah, there are a ton. Almost everything is a resource for growing – I feel like there are so many levels to being creative, one of the ways we are creative as people is in the way we do things; the way we design our day, the way we decide to eat what we're going to eat for lunch, how we're going to dress, what computer we're going to buy or how we're going to arrange our office – all creative choices If you're in the mindset of that, one can see any number of things as a tool for one's creativity, it doesn't just have to be paintbrushes and scripts and words. The way you drive to work, the way you walk around the house – those are all creative choices. Using the space of Twitter, not to sort of say here's a great thing that I did, although sometimes I might celebrate something. But as a jumping off point for other people to find their way to their creativity. If Twitter and Facebook can be used that way then it's a matter of perspective.	It can help in the way that it is fuel for something else. This is incredibly simplistic but I can sort of see computer users as two kinds of people. There are those that are just reactive and there are those who are responsive. You can be responsive to something you see on the internet and in technology based on what you do with it, you can print stuff out, you can change the colours, you can repurpose the things that you see and that you find or you can take the information and use it to create a story – you can do any number of things if you are willing to take in and interpret what you see as opposed to just sort of absorbing. One of the things I do in the world is I write for television, so when I watch television I've also written about this, it's also important for me to watch television like a professional which means I'm interpreting what are the choices they're making, and what are the angles they're shooting in and what are those acting choices and what are the colours, there's an activeness to my observing rather than a passiveness. That's the space that I believe can allow anybody to be fueled by technology as opposed to being deadened by it.	You have to do something but the doing, and this is a very interesting space in terms of a lot of my clients and a lot of writers in general, the doing has some parameters in terms of the doing at the professional level and then there's the doing at any level. One of the things that happens that shuts down creativity is the notion of what people are told, the boxes they're put in. A lot of writers come to me who are basically dealing with some version of, Hemingway woke up at 4 in the morning and wrote til noon and if I'm not doing that then I'm not a writer. They have this idea that being a creative person means X and anything outside of X means that they've failed as a creative person It does involve some showing up, if your art is created from post-its then you have to put some post-its on the wall, you don't have to put post-its on the walls for 8 hours a day or in the way that Picasso might have used post-its. But if you're not putting post-its on the wall then you're not actually engaged in the process of making something, creativity is all about making something. It's the difference between what Julia Cameron calls being an artist and being a shadow artist; a shadow artist is the one that's not showing up to actually put some things in place, the artist is taking the risk to put things in place

	Interview Question 4: What do you think are the most important elements to facilitate or support creativity? For example.. thinking safe spaces, functional mediums to express thoughts, or the ability to process negative feedback, or others?	Interview Question 5: Generally, what do you find is helping people most today? What would be 3 top recommendations or rules to keep our creativity alive?
Experts Interviewed:	**Reply Notes:**	**Reply Notes:**
Creativity Coach #7	One thing is time. One has to take the time. The other thing is permission in terms of both the permission to put something down on paper but also the permission to be brave about it. The other thing is there's a space of revision and revision requires flexibility; so it's like you create something but you're also committed to revisiting it and changing it a bit. One other thing, two things – forgiveness, I know a lot of artists I work with have this rigid view of what they're allowed to do and not allowed to do, if they send something out or written something and people don't like it or if this person likes it but this person doesn't like it, there's a whole space of self-condemnation that artists get into that shuts them down. The last thing is celebration, artists need to be willing to celebrate. They need to be able to say, look at this, I did this thing! Or showing it to your family and friends, or on Facebook, or sending into a contest that's essential. How is it that we take these people that are creating art and we sentence them to death in social media because they didn't like the movie.	One of them is to create space to percolate. The other thing I think is, I'm a big fan of going to your soul. Everything that I've written has come from something that I'm obsessed with or that I've dreamt about or that I can't get out of my head like why can't blah blah blah, or that was the most amazing blah blah blah. Quite often, especially in the world of dramatic writing, where we're looking at the Hollywood reporter and we're seeing all these movies and ideas, and there's a handful of people that come to me, maybe half of them who believe they want to reverse engineer something like Star Wars, where I saw that and I want to make something like that. I tell people to forget that, just go to what are you dreaming about. What are you obsessed with? Consider yourself the source and mine what's deep inside of you that is unique to you. That's the way to get creativity.
Creativity Coach #7	**Researcher Comments:** **• permission to be brave** **• space to revisit, revise and have flexibility** **• be willing to celebrate one's work where appropriate**	**Researcher Comments:** **• space to percolate** **• going to your soul** **• be excited and obsessed with greatness you are doing** **• dream, deep within**