

# Improvisation for Technology-Oriented People

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## Abstract

Teaching the “soft” skills to technical people is just as important as learning the “hard” skills. However, it is oftentimes left to the hiring company to fill in this void as most STEM related curricula are focused on the necessary science, math, and technical aspect of the related discipline. Creative problem-solving methodologies, design thinking, lateral thinking all tie into the use of improvisation. Companies are using the improvisation methods as a way of creating better collaborative teams and creating a work environment that says “Yes” before “No”. Improvisation training can help the rest of us to become better listeners, communicators, collaborators, innovators, and those who can focus on the organization or team story and not their own story.

KEYWORDS: Improvisation, innovation, creative problem solving

## 1. Introduction

Improvisation techniques can be used in teaching of technical concepts such as cybersecurity, agile development, database design, programming concepts, and most importantly, how to better one’s communication skills. In an age where rapid changes have become the norm, improvisation techniques can be used to help navigate the new challenges of the next generation careers, global interaction, and technologies. These techniques can easily be incorporated in other methodologies such as creative problem-solving, design thinking, and lateral thinking.

By the time I took my first improv class I was already well versed in the tenets of creative problem-solving. Between 2008 - 2009, I completed the Basadur creative problem methodology known as Simplexity. In 2009 and 2010, I conducted two half-day workshops at international conferences in Argentina and Brazil. In 2011, I attended the Creative Problem-Solving Institute Conference (CPSI) in Atlanta. In 2014, I spent a sabbatical in Africa where I gave talks on creative problem solving. Those experiences gave me a solid foundation in the creative problem-solving facilitation especially with culturally diverse groups.

In October 2016, I attended a local design thinking meetup where improvisation was used as an ideation tool to augment the creative problem-solving process. Later, I attended a 2-hour introductory course and then began working on ways to incorporate these ideas into my own teaching and daily life. One of the first lessons I learned was that there are clearly defined rules for doing improvisation and until they have been mastered, one should not break them. In the IT world, rules are the norm and this made it easy for me to see the value in using improvisation in my own teaching.

I also began taking formal improvisation classes starting in January 2017 from Improv Cincinnati which is a local improv company and have continued to do so even today. In September-2017, I began to give improv talks/workshop at mostly academic related

conferences. Over the next year, I spoke at a total of seven national/international conferences with one of them being both a non-academic and non-technical conference.

In October 2017, I attended the Midwest UX (User Experience) conference which was held in Cincinnati. I took a workshop on improvisation from Mike Gorgone who earned a master's degree in computer science from Loyola University in Chicago. His improvisation training was from both Second City and iO improv companies. His focus has been applying improvisation techniques and his technical expertise to help UX designers produce better research and ultimately digital products. Interestingly enough, Dick Costolo, the former CEO of Twitter (and friend of one of my Improv Cincinnati classmates), was a computer scientist and an accomplished improviser. Many technical people understand the need to be not just better technologically, but also to be better communicators as well.

In August 2018, I attended the Applied Improvisation Network (AIN) conference which focuses on how improv is being used in the non-theatre world from business leadership training to how to deal with patients who have dementia. This organization was founded in 2002 and grew out of the realization that improvisation can be used to help everyone learn better communication, leadership, and coping skills.

In February-March, 2019, I worked at Miras University in Kazakhstan on a project entitled "Multilingual Education via Interactive & Cognitive Teaching" which was out of their Computer Science and Information Technology department. The primary goal was "to upgrade professional skills of Miras University teaching staff that will further promote the cognitive, developmental, and professional growth of students." I conducted improv workshops for both their technical faculty as well as others including their English faculty. I also conducted a workshop for elementary and high school English teachers in one of the nearby rural areas. One of the challenges that I encountered was the participants level of English understanding varied which meant that sometimes I had to wait until my instructions were clearly understood.

While in Kazakhstan, I used both Storymatic Studios topic cards and Rory's Story Cubes as ways to have participants create new and more directed stories. These improv game tools worked particularly well with their English classes. It was both a way to teach vocabulary as well as have students create dialogs based upon the suggestions found on the cards or cubes. As a result of this work I have been invited back to Miras to conduct additional workshops for their foreign language department.

## **2. Brief Histories and Other Thoughts**

### **2.1 Improvisation**

The first known use of improvisation goes back to the Atellan Farce (fabula Atellana) dating back as far as 391 BCE, but seems to have faded by 55 BCE according to Cicero [1] and no written records appear to exist past the first century CE. [2] Improv was replaced by a new art form known as mime which did incorporate some of the concepts of improvisation.

In the 1500s the Commedia dell'Arte developed. Although it was performed in an unscripted format, the characters, plot, and locale were pre-set. It lasted until about 1800 and died out in part due the political nature of the shows themselves which led to suppression and eventual outright banning.

Another form of improvisation that was developed during this time-period was the Stegreiftheater in Austria. It was revived in the 1920 by Jacob Levy Moreno who saw benefit to patients being able to freely act out in a dramatic sort of way. The was called psychodrama and was used as a form of psychotherapy. [3]

Improvisation in music has been around for quite some time. A blog by Joy Morin called Color in My Piano talks about how improvisation was used in the early Renaissance music and classical music, but eventually faded from that genre to jazz in the 20th century. There is a very interesting book entitled "Lyric Composition through Improvisation" by Frederick William Schlieder which was published in 1927 which reflects this use.

Kazakhstan and other countries in Central Asia developed a form of a musical-poetry improvisation called the Aitysh or Aitys which was first documented by Vasily Vasilievich Radlov (1837-1918; aka Friedrich Wilhelm Radloff) and later Petr Ivanovich Pashino (1838-1891) in the 1800s [4]. The Aitysh is considered an ancient form of modern-day Rap. Its origins are unknown and no additional information was found by the author as to any real dates. During the Soviet times, the Aitysh was more of a propaganda tool, but has now gotten back to its truer roots once again.

Improvisation was resurrected as a theater art form in the 20th century through the independent work of Viola Spolin and Keith Johnston. Spolin defined what improvisation theater in the US would look like through her book "Improvisation for the Theater" which was first published in 1963. Johnston wrote "Impro: Improvisation and the Threatre" and created Theatresports. It is through the work of these two that codified improvisation and advance it in such a way that it could be applied in fields such as business, science, and medicine.

Other improv notables are Dudley Riggs who used the concept of "word jazz" and created the Brave New Workshop, Del Close who created a long-form version of improvisation called "The Harold", Paul Sills, the son of Spolin, who helped create The Second City, and Dick Chudnow who founded ComedySportz.

Two others that are very important to the development of modern theater are Konstantin Stanislavski who co-founded the Moscow Art Theatre and Augusto Boal who started the Theatre of the Oppressed and authored "Games for Actors and Non-Actors." The Alan Alda Center for Communicating Science at Stony Brook University, New York uses improvisation as part of their workshops aimed at scientist and health professionals. Some of their exercises are drawn from Stanislavski and Boal.

## **2.2 Creative Problem Solving**

Creative problem solving (CPS) process has its origins from work done by Alex F. Osborne in the 1930s who changed the word “brainstorm” from a negative connotation (usage in the late 1800s) to one used today for coming up with as many different ideas as possible in order to solve a problem. Later, he teamed up with Sidney Parnes and together they developed the modern concept of creative problem-solving. Out of their work grew the Creative Education Foundation in 1954 which held its first conference called the Creative Problem Solving Institute in 1955.

### **2.3 Design Thinking**

Design thinking was developed at IDEO back in the late 1970s and early 1980s. According to IDEO’s own website the foundations for design thinking can be traced back to work by Horst Rittel and Melvin Webber who coined the term “wicked problems” in 1973 or problems which are more complex in nature without a necessarily singular solution (one should also research reflective practice and John Dewey’s book entitled “The Quest for Certainty : A Study Of The Relation Of Knowledge And Action”, Minton, Balch and Company, 1929). Other works mentioned are the research by John Arnold of Stanford University and Richard Buchanan of Carnegie Mellon University and Case-Western University. My experience with design thinking has come from attending several related meetups and I found it to similar to other creative problem-solving methodologies.

### **2.4 Lateral Thinking**

I first came across lateral thinking when I was in working at the University of Rwanda in 2014 as I came across a book on the subject. Lateral thinking was developed by Edward de Bono in 1967 who also wrote the book “Six Thinking Hats”. It is another form of creative problem-solving. The improvisation concept of moving a story forward is similar to the “movement value” of lateral thinking.

The book however, was more focused on finding a singular solution for each of the puzzles. The one that most caught my attention was the snowman problem which read: “Five pieces of coal, a carrot and a scarf are lying on the lawn in front of a house. Nobody put them on the lawn but there is a perfectly logical reason why they are there. What is it?” The answer for someone who lives in a climate where they get snow and make human shaped snow structures, the answer is a snowman, but I was in Africa and this was not part of any of the Africans’ experiences.

Indeed, I tested this out at couple of talks I gave in Rwanda and Kenya. The answer I most often got was along the following lines: the scarf was blown there by the wind, someone (or animal) dropped the carrot on the ground or it grew there, and the five pieces of coal fell out of someone’s sack of coal that s/he was transporting. When audiences in the US give the answer “snowman”, I then state, “but, we are in the Kalahari Desert.”

This is in essence a wicked problem although it appeared at first to be quite simple. It should be clear that one’s own background, experiences, and education can either aid or hinder in finding the “correct” or best answer. Diverse teams made up of people with different experiences and backgrounds will have a better chance of solving such problems as even seemingly simple problems can be nearly impossible to solve without additional

parameters being known. Creative problem-solving along with a little improvisation can allow for a deeper exploration of different solutions. CPS is more formal and intended to come up with a serious and correct solution. However, improvisation training can aid in the finding of new and different solutions and can be used very effectively during a diverge-converge session of CPS.

### **3. Basic Rules of Improvisation**

The seven rules used here come from The Second City and are as follows: listen, use “Yes, and”, create an ensemble, co-create the story, be willing to change, use failure to improve, and follow the follower. Note: once these rules are mastered, it is OK to break them as long as everyone involved understands this ahead of time. Improvisation is fluid which makes it a good tool for creative problem-solving. Improvisation can be thought of method where the group begins in chaos which gives rise to order and eventually, we return to chaos.

#### **3.1 Listen**

Listening is a “muscle” that needs to be exercised and requires the following focus areas: the words themselves, emotion behind the words, the perceived intent of the words, and that the listener be in the moment and not thinking of what s/he may be planning on saying. Listen and only respond to what is heard. When someone speaks to you treat it as a special gift and acknowledge it as being so. Active listeners may either repeat what was said or paraphrase it. “Don’t be short on ears and long on mouth”, John Wayne.

#### **3.2 Yes, and ...**

By saying “yes”, one affirms the speaker and by saying “and” (as opposed to “but”) one indicates the intention to build on the speaker’s words. This way a story is built brick-by-brick. Such a method can take the performers (or problem solvers) to unexpected places and it may make one feel a bit at ease, but it is a way of keeping a clear line of communication open. Affirm, build, and being non-judgmental are keys to this phase of improvisation. In the old days of IBM, the company’s motto was “THINK”, but in improvisation (a brainstorming) it is best to “don’t bother to think” as some of the best lines and ideas often times come when performers say what is on their minds at that moment. A variation of this concept is saying “Yes, let’s ...” in response to an idea.

#### **3.3 Create an Ensemble**

The word ensemble is purposefully chosen as opposed to the word team. An ensemble of musicians for instance are brought together with the idea that they will create a beautiful musical piece and it is the whole that is important not the individual. The word team is often used to mean this as well, but in terms of athletics, teams imply that some level of competition was needed in order to be a member of the team and that one can easily be replaced or injured. An ensemble preserves the talent and the collaborations are highly synergistic. In order to be successful, ensembles must be in the moment, give and take, and surrender the right to be right (the last one is hard even in brainstorming sessions).

#### **3.4 Co-create the Story**

The focus here needs to be on finding The Idea, not one's own idea. This means that one must be willing to cede control which can be difficult. During this time, one needs to avoid asking questions as this can be seen as: blocking the idea from be developed, an attempt to force justification, avoidance, or just not wanting to participate. During this time of co-creation, a few basic rules of civility and behavior are needed. Basically, share the stage and treat every member with respect. Finally, it is important to remember that while some words or sayings may be funny to one person, they can be interpreted by another as having a negative connotation.

### **3.5 Change**

Changing oneself is very difficult and changing others or an organization is nearly impossible without first focusing on oneself. Improv can help in developing this as one is constantly faced with new ideas that s/he must adopt in order to keep a story moving forward. The SCARF (Status, Certainty, Autonomy, Relatedness, and Fairness) change management process is one that can help. Status work is part of improv and working with different status levels helps one see ideas from different perspectives.

### **3.6 Take Risks**

On November 2, 2016 I was reading "Improvisation for the Spirit" by Katie Goodman while watching the game 7 of the world series between the Chicago Cubs and the Cleveland Indians. In her book, Goodman wrote that risk taking is an important endeavor, but some risks such as betting on the Cubs to win the world series are not worth the trouble. I read this just as the Cubs tied the game at 7-a-piece. The being said, she could well be right for the next 108 years.

Taking risk has become a normal part of Silicon Valley and the startup mentality as a whole for quite some time. While failure is possible, the potential a big monetary payoff seems to make it worthwhile. But, what about risks that have no extrinsic reward, are they worth the time and effort? In the improv world, risk-taking and failure are how actors improve their future performances. Improv also helps one learn how to fail in public which can be very embarrassing and even emotionally upsetting if one is not trained for the possibility.

### **3.7 Use Failure**

It is not about being the best or perfect at that moment as much as it is about being in the moment and embracing the concept of life-long learning. These can lead to better creativity and innovation as one continues through their career. In the classes attended by the author, we used the word "Ahougá" when we made a mistake or faux pas of some sort. There are some improvisation exercises which have the purpose to force mistakes on the team members. Basically, saying Ahougá allows one to admit the mistake that caused no harm and then to move on without getting caught up in judgmental back-thinking.

Jim Ansaldo, a research scholar at Indiana University stated that "What improv really does is create a safe and fun and authentic environment in which to practice, where mistakes really don't matter.". Practicing making mistakes helps one get past those all too common ego busting, but trivial slip-ups.

### **3.8 Follow the Follower Who May Become the Leader**

This is a harder concept to grasp, but Spolin stated it this way “Don't initiate! Follow the initiator! Follow the follower.” All of us have the ability to lead and there are times when it is better for executives to step back and allow others to take over. Let things grow organically and see where it takes the ensemble. Too much direction from the top tends to negate any from below which in terms can stifle any creativity. Peter Drucker, who coined the term “knowledge worker” (1959) among other things, points out that organizations need to treat employees (or students) as assets not liabilities so as the world continues through dramatic technological changes, a well prepared and trained workforce can help organizations survive.

#### **4. LITERATURE REVIEW**

There is a fair amount of relevant research, articles, and talks on the use of improvisation outside of the theater. The Applied Improv Network grew out of the application of improvisation to help employers train their personnel better communication and leadership skills. What follows is a summary of some of the literature found by the author that covers the various applications of improvisation in terms of research, learning, communication, innovation, and application thereof. The articles reviewed come from people with diverse backgrounds and experiences; yet, all of them point to using the precepts of improvisation as a way to improve individual and team communication, collaboration, creativity, problem-solving skills, and innovation.

1 “Beyond Productivity: Information, Technology, Innovation, and Creativity” by the Committee on Information Technology and Creativity, edited by William J. Mitchell, Alan S. Inouye, and Marjory S. Blumenthal [5]

This is a rather lengthy book with a theme revolving around the importance combining both the arts and STEM disciplines in order for the next generation of problem solvers and innovators to be successful. It is stated that this is “also an opportunity for each field to gain fresh, sometime uncomfortable, perspectives on itself.” It is pointed out that Pixar co-founder, Ed Catmull, embraced improvisation as a way to teach better collaboration within teams. Also, the idea of using software tools (such as Trello and XMind) can be used to further collaboration and creativity. It is further stated that improvisation has a place in human-computer interaction (and in the development artificial intelligent systems). Finally, there are several references made to George E. Lewis who is a professor of American Music at Columbia University A very good quote from Lewis is “Improvisation is about finding structure, not imposing it.”

2 “Improv for Effective Collaboration Innovation?” by Jeannie Kristufek [6].

In her paper, she presents several exercises used at IBM that she adapted from the improv world to help technical team members work more creatively and efficiently as part of a collective whole. A key component of improvisation is that it is a team effort and that no “star” exists. Everyone is tasked with contributing to the task at hand and one must listen to the other team members even if there is disagreement. The prime rule of improv is “Yes, and” a statement made to you in order to keep the conversation going. Avoiding the value-judging of ideas presenting and allowing all members of a team to have a voice in the discussion is important. Several other key components of improv that she points out are:

“show, don’t tell”, take risks, be in the moment and the know, and finally, remember that collaboration + innovation = collabovation.

3 “Using Improvisation to Enhance the Effectiveness of Brainstorming” by Elizabeth Gerber [7].

In this paper, Gerber explores how improv can be used to enhance the brainstorming process. She honed her improvisation facilitation skills by teaching 60 practitioners and 110 undergraduate and graduate students over a five-year period. She points out that individual brainstorming is an important component and should not be neglected. A key element of successful brainstorming and improvisation is to have a safe environment where members can express their thoughts without some form of value-judging being given. The purpose of her research was to show that improvisation training can help collaboration become more productive and satisfying for all involved.

4 “Whose Classroom Is It, Anyway? Improvisation as a Teaching Tool” by Ronald A. Berk and Rosalind H. Trieber [8]

The focus was on using improvisation as a better way to engage and teach the Net Generation students. The authors used the following four improv exercises to demonstrate how this can be done: One Word at a Time/One Sentence at a Time, Speech Tag, Freeze Tag, Gibberish Expert Interview. They include a questionnaire that was used with the students after the activities. Also covered are the seven principles of improvisation: trust, acceptance, attentive listening, spontaneity, storytelling, nonverbal communication, and warm-ups. Finally, they gave four reasons for using improvisation in the classroom: 1. it is consistent with the characteristics of the current generation of students; 2. it taps into students’ multiple and emotional intelligences; 3. it fosters collaborative learning; and 4. it promotes deep learning through the active engagement.

5 “The use of improvisational theater training to reduce social anxiety in adolescents” by Peter Felsman, Colleen M. Seiferta, Joseph A. Himle [9]

This was a study done in Detroit in cooperation with The Improv Project which is a part of the Detroit Creativity Project (DCP). The authors state “This study is the first to test the efficacy of a school-based improvisational theater program as a mental health intervention, and it offers positive results.” The focus was on those youth who suffer from a recognized social anxiety disorder such as depression or social avoidance.

I met with Beth Hagenlocker who is a co-founder of the DCP and in charge of the day-to-day operation of The Improv Project and she shared with me the 10-week syllabus used in the program. Students transition from the basic week 1 exercise of Zip-Zap-Zop to “Yes, anding”, and finally to point-of-view storytelling and status exploration. At the end of the 10 weeks they put on a performance which I was able to attend in April 2019. The syllabus is broken down into three weekly key areas: Session Focus, Performance Target, and Life Skills Target. The “graduation” performance was given by three different student groups. The young performers showed a mix of “quick on one’s feet” thinking and pure raw talent. Besides the work being done in Detroit, others are also using improv as a way to socially disadvantage. In Boston, Urban Improv has been around since 1992 and is a part of Rehearsal for Life. This program has also been used in Washington DC as well.

6 “Humour-in-the-loop: Improvised Theatre with Interactive Machine Learning Systems” by Kory Mathewson [10].

Mathewson is an accomplished improviser and in 2015, he began his work on creating an AI system that could engage in improvisation with a human. He developed a set of Turing test rules that could be used to show success. He collaborated with Rapid Fire Theatre on this project and it is also here where he introduced Improbatics. He states that “failure teaches more than success” which is an important tenet of improvisation. Another paper of his is entitled “Improvised Comedy as a Turing Test.”

7 “Want to Be a Better Scientist? Take an Improv Class” by Catherine Barlett, PhD [11].

This short article appears in the Scientific American blog. Barlett covers several key elements of improvisation such as listening, active engagement, and having fun. She is a scientist and an introvert who works at the Arizona-Sonora Desert Museum. She found that giving talks to the general public was difficult. She references research being done by NASA’s Jeffrey Johnson based on the idea that humor is an important component for team success including for the crew of a future trip to Mars. She also references the Alan Alda Center for Communicating Science as well as other resources.

8 “Changes in Anxiety Following a Randomized Control Trial of a Theatre-based Intervention for Youth with Autism Spectrum Disorder” by Blythe A. Corbett, PhD, Scott D. Blain, Sara Ioannou, and Maddie Balsler [12]

This research looks at how improvisation skills can help children better at communication and other interpersonal interactions using theater techniques such as improvisation, role-playing, scripted interaction, and performing. Her work indicates that improvisation techniques can be used to help people on the autism spectrum disorder (ASD). There are a number of studies that she points to and she suggests that additional work in this area is needed. She created the Social Emotional NeuroScience Endocrinology (SENSE) lab “to better understand the social and emotional functioning of children with autism and related neurodevelopmental disorders and to translate findings into meaningful approaches and interventions.” She also founded the SENSE Theatre intervention program “to enhance social competence in autism.” Her paper entitled “SENSE Theatre: a Promising Intervention for Children with Autism Spectrum Disorders” further shows that acting and improvisation skills can help improve their socioemotional functioning.

Besides Dr. Corbett’s research on the use of improvisation with those with ASD, The Second City offers 8-week workshops for autistic adults and youth and have even expanded their program through a partnership with Lisle-based Giant Steps. In an article found on [www.psychiatryadvisor.com](http://www.psychiatryadvisor.com), they say that “improv offers an opportunity to practice communication skills — including talking to people and looking them in the eye, and listening and relating to others.”

A while back, I talked with Kari Kelly who was diagnosed with Asperger’s syndrome and is an alumnus of Improv Cincinnati. She has a master’s degree in physics, but found it difficult to relate and communicate with others. Improvisation training helped her learn the

skills she needed in order to advance herself and her career. Now she runs her own business where she teaches the Scrum agile methodology and general soft skills.

9 “Education in Professionalism: Improvisation” by Richard B. Gunderman, MD, PhD [13]  
This paper looks at how Dr. David Fessel, MD, a musculoskeletal radiologist and faculty member at the University of Michigan who took classes on improvisation and eventually became a member of The Second City Conservatory. His primary reason was to overcome his initial fear of giving presentations, but eventually he realized there much more to this. The lessons he learned were that improvisation reaches far beyond that of comedy and apply directly to the medical profession in terms of team work, collaborative communication, relationship building, learning, and self-awareness.

I had the privilege of taking an improv class with Dr. Scott Jolson who specializes in sports medicine and arthroscopy surgery in Cincinnati. I asked him why he was taking these classes and his answer was to not only make him a better doctor, but also that he was hoping to teach new doctors how these techniques could be used to make themselves better medical practitioners.

10. “From Fear to Discovery: The Science behind the Practice of Improvisational Behaviors”, by Brave New Workshop (BNW), 2013. [14]

This white paper was written by the people from the BNW which is located in Minneapolis, MN and is one of the oldest improvisation companies in the USA having started in 1958. The focus of this paper is on the what they call the Mindset of Discovery which has five key behaviors: listen, defer judgement, reframe, declare, and jump in. Improvisational theater acts are based upon similar guidelines with the idea that the actors are there to support one another and to advance the story and embrace the twists and turns to some form of a conclusion without judging the performance until afterwards. The paper reviews a fair number of scientific research and the authors talk about how improvisation can help companies develop a more productive workforce. They also reference the work by Dr. Charles Limb (see table 5.1) regarding his work into how improv aids brain development.

11. “Improvisation: Methods and Models” by Jeff Pressing, La Trobe University, Australia [15]

This paper was written in 1987 and although this paper is mostly on musically improvisation, many of the ideas could easily be applied to theater improvisation as well. Even more interesting is the section on Artificial Intelligence that Pressing examines. Pressing notes that “There is traditionally no explicit mention of improvisation in the field. In making such a link, it seems clear that the successful application of AI concepts to improvisation rests to a large degree on the appropriateness of considering improvisation to be a kind of problem-solving.” He proceeds to discuss how improvisation is really a form of problem-solving in terms of search method and selection of an appropriate or acceptable solution through problem reduction.

He also discusses the different areas of AI knowledge representation including how semantic nets may be best suited for the music improvisation area, but challenging to wholly represent. Multiple representation implies parallel-processing which requires both

cooperation and collaboration and in jazz improv this is a key element when multiple musicians are “jamming” together. He refers to D. A. Levitt 1981 masters’ thesis entitled “A Melody description System for Jazz Improvisation” as an early attempt to create an AI improvisation system. There have been more attempts since then.

Later he examines four different perspectives that can examine as possibilities for an improviser’s choice: intuitive, residual decision-making, physicalist, random. Intuitive improvisation is untestable while residual and physicalist imply the ability to improvise based upon the notion of free-will or not. The fourth perspective is where an improviser starts out randomly but also choosing a path or destination. As one hones this skill through practice it will appear to be a little less random and more polished. In theater improv this is done through an audience suggestion (or suggestions) where stories start out randomly and eventually converge (hopefully) towards an acceptable outcome for the listeners.

12. “Improvisational Computational Storytelling in Open Worlds” by Lara J Martin, Brent Harrison, and Mark Riedl [16]

Improvised story-telling allows the actors to place their characters in whatever universe and situation they wish based upon a simple suggestion from someone in the audience in essence what is referred to as an open world. The authors are researching how to do the same with an AI system that would be capable of improvising with humans in real-time alongside humans. They suggest using an open story generator such as Scheherazade which was created at Georgia Tech’s School of Interactive Computing. They offer two possible approaches to help solve this problem: plot graph and neural network. Neither solution is perfect and much more needs to be done, but the goal is to develop an AI system that can communicate with humans at even some of the more abstract worlds we live in that improvisers are good at creating.

## 5. ADDITIONAL RESOURCES

There are a fair number of TED and TEDx talks related to improvisation including one with Keith Johnstone. The table below has a list of the ones that the author viewed on YouTube and found to be most related to the application of improv to create better team dynamics, creativity, innovation, and communication.

There are a large number of books and websites dedicated to improvisation both theater-related and applied/business related. The table below is a list of books that the author has either read or that have been recommended. The Upright Citizens Brigade book contains a lot of examples of do’s and don’ts for performers, but in many cases, these can easily be transferred to one’s own work environment.

**Table 5.1: TED and TEDx Talks on Improvisation**

	Presenter -- Title of Talk and Key Takeaway
1	Dave Morris -- The Way of Improvisation Improvisation is a process and life itself is improvised.. He created a Periodic Table of Improvisation which highlights the key areas of improv including a list of some of the key persons responsible for its development
2	Vicky Saye Henderson -- Improvisation Exercises

	Make your partner look good and insanely smart; create an environment of trust
3	Steve Matuszak -- The Art of Improvisation When one starts from nothing, anything is possible
4	Paul Z Jackson -- The Power of 'Yes...And' Co-founder of the Applied Improvisation Network Impro learning: How to make your training creative, flexible, and spontaneous References Augusto Boal 58-1/2 ways to Improvise
5	Karen Tilstra -- Two Words That Can Change the World Yes – I am suspending judgement And – I will help move the idea forward
6	Zach Beattie -- The Art of Improvisation Stop dividing people into the "creatives" and the "non-creatives"; improv is a process that is about spontaneity, imagination, and taking the unexpected and doing something with it that itself can be unexpected.
7	Natalie Nixon -- Seven Rules for Improvising at Work “Yes to the Mess: Surprising Leadership Lessons from Jazz” - Frank Barrett Chaordic system – Dee Ward Hock (founder VISA)
8	Charles Limb -- Your Brain on Improv Put jazz musicians and rappers in an fMRI; during improvisation; their brains turn off areas linked to self-censoring and inhibition and turn those of self-expression
9	Uri Alon -- Scientific Research and ... Improv? Saying “yes, and”, can help scientist to bypass fear and skepticism, and in so doing unlock their inner creativity
10	Andrew Tarvin (humor engineer) -- Humor at Work At P&G, taught his team to use improv to improve
11	Rachel Stromberg -- What Improv Has Taught Me about Leadership; Training & Development at Allstate Girl scouts and how improv became a part of her life

**Table 5.2: Books on Improvisation**

	Title	Author(s)
1	Yes, And – Lessons from The Second City	Kelly Leonard and Tom Yorton
2	Getting to “Yes And” The Art of Business Improv	Bob Kulhan
3	Applied Improvisation for Coaches and Leaders	Susanne Schinko-Fischli
4	Upright Citizens Brigade Comedy Improvisation Manual	M. Besser, I. Roberts, & M. Walsh
5	Improv for Everyone	Greg Tavares
6	Go with It: Embrace the Unexpected to Drive Change	Karen Hough

**Table 5.3: Improvisation Related Websites**

	Website Name	Person(s) Responsible
1	Improv for Everyone	Fred Gleeck & Avish Parashar

2	Yes And.com	Jimmy Carrane
3	Improv Encyclopedia	unknown
4	Improv Resource Center	Kevin Mullaney
5	Learn Improv.com	Hugh MacLeod
6	Comedy in the Classroom.org	Academics at the U of East Anglia, UK
7	Spolin Games Online	Gary Schwartz
8	PVImprov on YouTube	Paul Vaillancourt
9	Improvwiki.com	Guido Boyke and others
10	Improvised Life.com	Sally Schneider

## 6. IMPROV EXERCISES

There are a set of exercises that I tend to use most often in my cybersecurity class that I find works fairly well getting students to work together and to learn to concentrate on their surroundings. Below is a look at the exercises used in the author's classes or workshops along with a brief summary.

**Table 6.1: Improv Exercises Used by the Author**

	Most exercises can be found in the Improv Encyclopedia, Improv Wiki, Drama Toolkit, or others sites mentioned.	
1	Shake 8s; Circle up	A great warmup exercise; I have even done this with words instead of numbers
2	Zip-zap-zoop; Woosh-bang-pow	Any 3 words, sounds that you want to use as they get passed around in increasingly more complicated manner invariably causing an 'ahouga' moment
3	These are five things	"don't bother to think"; just do
4	Follow the follower or the Leader	Great exercise and fun as people imitate others, try to figure out who leader really is, or follow a new leader
5	Last word – first word	Forces students to concentrate the last word spoken
6	New choice; Ding; Redo, Refactor	I refer to this game as Refactor which is a term used by programmers when they rewrite some of their code. It forces you to rethink an idea or way of saying something or even doing something totally differently.
7	Noun association; Double-link list	First just go in a circle saying whatever "noun" you think of. Once the loop has gone around repeat the cycle using the same words. Build on this by adding 2 or more rounds with a different set of words to see how well you can remember your words or that of others. Use "pointers" to other people in the circle to complete a circuit.
8	Zombie/hacker attack	Best with 10-14 people. One person plays the zombie. Have the same number of chairs a people which means one will be empty. The zombie walks slowly toward the empty chair while the others must create a team strategy to cover it thus creating another empty chair elsewhere.

9	Wink that kills Used in my cybersecurity class where one student is pick to be a virus and can infect a target by winking. The others must catch the virus before all are infected.
10	Botnet, Distributed denial of service or DDoS attack Similar to the above game, but now the winker (bot herder) creates a botnet that s/he can later command to attack a victim who represents an organizations website.
11	Bomber-protector; Virus-antivirus Use 6-10 students; each student identifies one student as their bomber (therefore to be avoided) and another student as their protector (therefore wanting to stay as close as possible to). The other students observe the interactions between the group as they move around.
12	2 or 3 headed experts There are multiple variations of the “experts” game, but in general a question is asked by someone in the audience and the experts answer the question using various formats such as 1-word at a time or 1-sentence at a time.
13	4 square or 4 corners; Shift left/right 4 players with the front two being given a topic they will discuss. They will rotate around so that each player will be covering two different topics with their neighbors.
14	Gibberish Expert, Command, Malapropism Practice making sounds with expression and emotions to get an idea across
15	Freeze Tag 2 players at a time start a conversation and another person can replace one of the two by saying freeze and create new conversation
16	Circle Story This can be about whatever topic you want. Add a twist to it by having some of the people say as familiar “saying” of a famous person or of a relative in the middle of the story
17	Four Square, Four Corners, Rotation 3-5 players with the front two being given a topic they will discuss. The director will rotate them around so that each player will be covering two different topics with their neighbors
18	Emo Zone; Emotional Workplace; Allows for team members to work with different emotions that identified by what space one occupies
19	Status Game Can be played by using a deck of cards or in some other format. Treat others based upon their perceived status. Putting in a “joker” can mix things up
20	Sexy, Silly, Stinky Sexy-silly-stinky game involves 4 people who endow each of the other 3 with one of those attributes and then interact with one another.
21	Alphabet Circle Use the alphabet to tell a story or have a conversation. Challenging when one gets to lesser used letters
22	Knife-Cat-Baby Throwing

This is about object work and concentration as it can get confusing when suddenly one of the objects get duplicated by accident.
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## 7. Conclusions

Improvisation training is meant to help two or more people create a story using a form of constructive dialog. In 1992 Bonnie Tinker create a methodology called LARA (Listening, Affirm, Respond, Add) to help with the divisive talk that was going on regarding rights for the LGBTQ community. It follows the most important tenets of improv. A conversation can't occur without both parties involved being actively engaged, in the moment, listening, and affirming what was said whether or not one agrees with the other person's statement. It is all about helping to build THE story which becomes OUR story.

Since 2016, Northeastern University computer science majors have been required to take a drama class which includes improvisation. [17] This is done in part in an attempt to "robot-proof" their majors as well as giving them better teamwork and creative problem-solving skills. As shown in this paper, the area of artificial intelligence research has begun to look at how improvisation theatre can be used to help develop AI systems that can truly converse with us. This research is within the realm of computer science as well as other related domains. Another area of applying computer science to improv was the thesis work of Dustin Freeman where he applied some very advance video methods to the improv stage. [18]

There are anecdotal, testimonials, and research that supports how improvisation can help everyone become better researchers, technologists, teachers, entrepreneurs, team members, and humans. The author has applied some of these techniques in his beginning cybersecurity class as a way to teaching concepts and also creating better observation skills of students. The author intends to create more exercises that are related to additional Information Technology concepts.

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