Minds in the Spotlight: Using Live Performance Art to Uncover Creative Thinking Processes

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Abstract

Several buzzwords seem to permeate all sectors and disciplines: creativity, innovation, and interdisciplinarity. Despite their ubiquity and inherent theoretical relatedness, they remain disjointed concepts in practice. Bridging theory to practice becomes relevant as emerging intelligent systems necessitate more human-like qualities. While computers can store information at unprecedented levels of speed and accuracy, they lack our ability to integrate stored with new, incoming information to adapt in pursuit of a goal. I believe that to create more human-like intelligent systems, we must refocus our attention to understanding how complex webs of information such as audiovisual input, language, and emotion processing cohere into a whole. Creativity is a mental phenomenon that precisely engages multiple cognitive processes to generate novel solutions to problems. My approach is two-fold: break down the artistic, spontaneous creative process in real time, and in doing so, introduce a novel educational and entertaining experience to the general public. In this paper I argue that to study creativity effectively, and communicate empirical questions and research productively, a revision of experimental methods, data acquisition, and presentation format must be both uncontrolled and interdisciplinary. I discuss novel results from live musical improvisation within theatre to dissect spontaneous adaptability.

Introduction

Innovative reform, be it within business, education, healthcare, information technology, or government is at the top of everyone's list. Change is needed, and fast and effectively, because we are facing extremes: our environment has reached a state of planetary emergency, globalization is affecting economic trends in unprecedented ways, and technology is altering how we think and act.[1-3] And while ingenious forms of problem solving are needed to deal with such imposing issues, as acknowledged by lead figures, society, ironically, is experiencing a crisis as it deals with critical lows in creative thinking skills in both children and adults and overall productivity and innovation in the workplace and beyond.[4-6] Such a paradoxical coexistence is unsurprising, however. As prominent psychologist on creativity Mihaly Csikszentmihalyi states, "each of us is born with two contradictory sets of instructions: a conservative tendency, made up of instincts for self-preservation, self-aggrandizement, and saving energy, and an expansive tendency made up of instincts for exploring, for enjoying novelty and risk. We need both. But whereas the first tendency requires little encouragement, the second can wilt if it is not cultivated."[7] As a result of our evolution, therefore, humans engage both in basic activities that have direct, obvious survival impact such as sourcing for food, eating and mating, and in activities more abstract that result from our recognition of the indirect, potential impact of highly skilled creative behavior for further physical and intellectual advancement. A glimpse at the archeological record of Paleolithic technology provides provocative evidence suggesting a direct correlation between tool making and function with the evolution of complex mental capacities (such as natural language) exclusive to humans.[8] A broader glance of human history, say, from the Age of Enlightenment to the Industrial Revolution to the Digital Age, reveals our consistent, progressive drive as a species.

Definitions

As such, from business to technology, science to politics, environment to art, three main words seem to dominate everyday marketing discourse in some form or another: Creativity, Innovation, and Interdisciplinarity. Moving beyond the glamorous sound of each of these words, we unfortunately find ourselves in a landscape of conceptual complexity and societal ambivalence not quite set up to unify all the elements into one cohesive, aesthetic and efficient garden so-to-speak. I begin, therefore, with definitions.

Creativity

Creativity, a fundamental of human cognitive capacity, refers to the generation of something uniquely novel (and not necessarily overtly and immediately useful for survival).[9] Under the *creative cognition approach* creativity is far from a magical process and arises from the interaction of multiple cognitive processes otherwise used in noncreative situations such as focused attention, emotion, memory, reasoning, reflective decision-making judgments and action.[10,11] Exactly how all these processes interact, along with seemingly random bouts of impulsivity, inspiration, and intense energy in any given creative (artistic) moment, is a question underlying research in creative thinking.[12] Part of understanding creativity, whether improvisatory and short-term or planned and long-term, is dissecting the result(s) of creative behavior.

We can turn to every day use of natural language and conversation to begin to grapple with what creative behavior within a particular conceptual space entails. From a finite set of elements, speakers of any language can produce an infinite number of novel expressions to communicate a vast range of ideas. As a case in point, consider your most recent conversations and notice how incredibly different they were from one another, even if they addressed the same topic and were had with the same interlocutors. In a similar vein, consider music, another hierarchical, combinatorial communicative system that relies on rules, is equally expressive, and combines a finite set of notes and rhythms to produce an infinite range of musical phrases within a given musical idiom.[13] From the radio's playlist of pop songs to the concert hall to the intimate jazz club, for example, every musical experience is without question vastly distinct. Language (and music) not only exemplifies the constant refashioning and recontextualization of linguistic (and musical) resources during communication, but also most importantly, highlights the generative and creative nature of an adaptive system such as ourselves. Adapting behavior to a specific situation is essential for

getting things done, and within the context of a conversation, means anchoring dialogue on the shared interlocutor's representation of the topics in the subject matter at present[14] and reaching a maximal, effective exchange of information through cooperation.[15] Key to the conversation or task at hand is our ability to consider the elements within our surrounding environment, throw options back and forth as in a tennis match, evaluate and filter them by choosing an optimal option (or one believed to be most optimal) in response to emotional and/or intellectual reasons, and integrate it within the task being performed. Taking this a step further to spontaneous, human-machine interaction, this is the very problem that makes online search engines impersonalized, inegalitarian, and ultimately frustrating: when you search for something on the web you get in return the most popular (i.e. statistically relevant) and semantically-alike hits related to your search topic and nothing that shows knowledge of and interest in your motivations, personality, or past, current, or near-future intentions.[16] As such, current artificial intelligent systems cannot have what we consider a truly meaningful conversation because they lack the real-time adaptive ability to learn from and be creative with us, their human online searcher. More specifically, as Quek *et al.* notably posit, "for human-computer interaction to approach the level of transparency of interhuman discourse, we need to understand the phenomenology of conversational interaction and the kinds of extractable features that can aid in its comprehension."[17] (p. 172) I believe, therefore, that we need to focus our efforts in not only teaching machines lower level, and no doubt complex, visual feats such as identifying images of cats from canonical to an infinite array of positions, but simultaneously investing appropriate resources to the human cognitive extreme of heightened perceiving, thinking, and acting which is, and what I will entertain in this paper, exemplified within spontaneous, artistic creativity.

Innovation

The very product of creativity is innovation. Without creativity, there is no innovation. But in order for novel ideas to be expressed, processes to be discovered, devices to be developed, healthy competition to grow, and the unexpected to arise, resources need to be allocated to creative endeavors that allow for such innovations. The field of science and technology, as we know it today, appears to be in decline when it comes to unique, innovative production, for example, due to both the increasing complexity of problems to solve and the consequent increasing economic, educational, and social demands they simultaneously impose.[6] One perspective is not enough to solve problems within one discipline, and individual creativity, notwithstanding popular belief, is the result of (in)direct interactions with many individuals.[18]

Interdisciplinarity

Which brings us to the topic of interdisciplinarity. In its simplest of definitions, interdisciplinarity refers to the integration of various components from two or more disciplines. More specifically, interdisciplinarity results from the following variables coming into play: the number of disciplines brought into the mixture, the degree of novelty between the components from the disciplines in question, the categorical distance between the characteristics of the components under consideration, and the actual integration of the mixture.[19] How to integrate several elements from more than one discipline is where the complexity, and ultimate challenge, of interdisciplinary innovation lies. As an interdisciplinarian myself between the fields of Science and Art, I find that genuine integration of disciplines requires two fundamental building blocks: an intimate knowledge set of each

discipline to be integrated and mixed, and an unabashed attitude to embrace the unknown, the truly unexpected. My approach to the study of creativity relies on these very two building blocks.

In an effort to understand human spontaneous artistic adaptability as it occurs in real time, I have created novel works within the audiovisual world of film and theatre to innovate both the way empirical research on creative thinking is conducted within the field of cognitive psychology and the particular art forms themselves. Science by definition is about reductionism and control for the purpose of obtaining clear, reproducible results. Art, in contrast, is about openness and spontaneity and unstable results replete with in-the-moment explorations, variations, and transformations. Given the overall spontaneity of and sensorial richness surrounding creativity, my approach to its study is equally amenable to and in search of unexpected discovery and irreproducible results. Returning to eminent psychologist J.P. Guildford's earliest experimental proposals for studying emergent behavior,[20] known as the "frustration test," I adopt his "do something…whatever you think should be done" (p. 452) approach in search for maximally different results. More specifically, I utilize improvised music to fully scripted works as data to breakdown how complex visual information and narrative language are spontaneously translated into musical language. For a detailed discussion and analysis of a novel study of improvised music to a silent film and within a Spanish-language theatrical production, see López-González (2015).[21] I choose music and the visual and performing arts' worlds because of their live, integrative multisensory artistic experiences; and film and theatre offer rich platforms for such experimentation outside of the traditional laboratory setting. Continuing in this vein, I discuss here a new project titled *In Session* (*Chez L'Analyste*)[22] which was funded and produced in English by La Petite Noiseuse Productions in 2015.

Methodology

In Session is a new one-act theatrical play that addresses fundamental questions about intelligence such as perception, consciousness, and memory. Now more than ever the field of artificial intelligence (AI) is moving forward in leaps. Although the general public engages daily with the products of AI technology, knowledge of the back-end details of AI is not necessarily on the list of prerequisites. Furthermore, as intelligent technologies demand more creative and emotional authenticity and nuanced human-centered systems are built,[23,24] fully understanding how we integrate multimodal information in parallel as we adapt to an ever-changing environment becomes more and more of a priority. It is from these observations that I argue for an interdisciplinary and relatively uncontrolled Science-Art approach to both the public presentation of empirical topics and the study of creative thinking, a fundamental feature of human intelligence yet to be perfected within AI and the ultimate goal of cognitive computing.[25] I wrote *In Session* precisely to bridge the gap between science and society with the goal of peering into an aspect of artistic, improvisational adaptability: bring to drama what science questioning, investigating, and theorizing are all about, and bring to science what live dramatic storytelling, irreproducible impulsive discovery, and dynamic associations and interpretation(s) are all about.

In Session: The Play's Specs

"Life is a kaleidoscope of ever-changing scenes and we are but mere characters of circumstance. Sometimes the light shines above and focuses on us for a fleeting

moment… but most times we remain backstage in the dark, behind the cyclorama of focused events," (ii, p. 69)

says the Client character to the Psychotherapist character in a moment of heightened sensitivity to the stage as metaphor for the uncertainty and obscurity of creative invention and, more grandly, life.[22] *In Session*, which I originally wrote in French under the title *Chez L'Analyste*, is an original one-act dramatic play I also directed and acted in to bring together three fictitious characters on stage: a psychotherapist, a client, and a pianist. Purposefully moving away from the stereotypical, fictional versions of psychotherapeutic sessions and their couches and inevitable lewd revelations, I chose psychotherapy as a natural conversational paradigm to address more cerebral issues such as the what and how of human thought, perception, emotion, memory formation and decay, dream states, and awareness of self and self within society. The play is a thought experiment in consciousness and is guided by the following question: what can I learn about the underlying differences, if any exist, between being human and being an intelligent machine if I take two characters, a psychotherapist and her android-like plastic-surgeon client, throw them in an office, and let them debate the ins and outs of their societal roles while unraveling their personal stories in a single, final session (see Figure 1 for a scene of the staged conversational setup in the psychotherapist's office).

Figure 1. *Photo still from live theatrical production of* In Session *performed in Baltimore, MD May-June 2015. The 'Client' and 'Therapist' characters face off.*

In a twist of narrative fate where minds mimic machines and reality and illusion are one and the same, the psychotherapist and client (inadvertently) switch roles… (see Figure 2).

Figure 2. *Photo still from live theatrical production of* In Session *performed in Baltimore, MD May-June 2015. The 'Client' and 'Therapist' characters reverse roles and become 'Doctor' and 'Patient', respectively.*

And with yet another nod to Surrealism, the theatrical work also introduces a pianist who improvises live on stage (between curtain legs to view the stage's action but remain invisible to the audience) the office radio's music every time the play is performed. I specifically created the pianist's character to translate and transform the emotional and conceptual narrative of both the dialogue and the scene either as musical background, spontaneously determined by the pianist in the moment, or as a third reacting character to the ongoing dialogue and body language of the actors as explicitly instructed in the script during conversational moments or silences between the characters.

And because *In Session* doubles as an educational experience for the attending audience, topics from cognitive psychology were woven into the following six scenes:

i. *Case Study X* where we learn about the Client's dissatisfaction (a) at work with her patients who've undergone a number of aesthetic surgeries and cannot cope with their transformations, and (b) with herself for being plagued by the long ago suicide of her identical twin sister (Sophie) who had undergone facial transplantation after a freak accident.

ii. *Negative Feelings Released* finds the Client and Psychotherapist playacting in a reversal of roles as the Client becomes the Psychotherapist's doctor when she begins to reveal distressing moments from her past.

iii. *DSM X: Human vs. Non-human* explicitly questions the very category of being human as the Client deliberately confuses the Psychotherapist by forcing her to define her humanness: to what extent does thought, emotion perception, memory retrieval, and (self) awareness make us uniquely human?

iv. *Terminal Illness: Existence* has the Client waxing bluntly and unapologetically about the humdrum purpose of life and the caustic effects of consciousness.

v. *The nth Fall* is the Psychotherapist's personal monologue, a fully painted landscape of why she entered psychotherapy and the profound effect of a previous client's face-to-face elaborate suicide in Paris, France – as recounted from memory– on her emotional and intellectual (in)stability.

vi. *Farewell At Last* comes right as the Client pushes the Psychotherapist to her emotional limit only to find vulnerability, uneasiness, and no solution in sight for who and what her Client really was (a real client or a manifestation of her inner voice) and what she ultimately wants from psychotherapy as a profession.

Musical Improvisation Within Theatre

This creative type of presentation offers the musician, as a solo instrumentalist, a complex environment to create, develop and transform musical ideas from visual and literary cues in real time. Unlike long-term composition with its many layers of fine-tuning,[26] the improviser within a live performance context does not have the opportunity to rewind and revise or edit in search of a "better" solution. The result, therefore, is an immediate solution consisting of different and unique music every performance. In contrast to my previous film and theatre projects where I created emotional visual and linguistic stimuli specific to the six basic universal human emotions (i.e. anger, disgust, fear, happiness, sadness, surprise),[21] this project, although full of emotional moments, was about ideas and specific concepts. The current

project took on a more analytical tone in an effort to offer the improvising musician a unique space from which to react to content not easily identifiable as emotional, i.e. sensory systems and conscious awareness in the current project vs. happy and sad states in the previous projects. Music is after all a highly intricate auditory stimulus rich in socio-cultural emotional meaning and interpretation[27,28] and a universal communicative medium. A method used to understand how music "translates" emotional meaning is by determining which musical features are correlated with the perceived meaning.[29] The question then becomes: what will a musician spontaneously do when emotion is not an obvious cue to latch onto? More specifically, what type of musical "translation" will be done?

The pianist who improvised the music for every performance had an average of 11 years professional experience as a performer and composer and although had done several musical theatre projects containing scored orchestral work before, had not improvised live for a theatrical production of this type. I met with the pianist several weeks prior to rehearsals with the other actor to discuss his role, the overall storyline, and the use of a particular French song (*Ne me quitte pas* ("Don't leave me") by singer-songwriter Jacques Brel) I requested to be implemented as part of the melodic foundation from which to improvise during a section of Scene v. The pianist then attended the last week of rehearsals to familiarize himself with the dialogue, stage and musical entrance cues explicitly noted in the text, and timing between scenes. A soundtrack, however, was not charted out or scored to allow for unbiased improvisations during performances. The play was presented to the public thirteen times in the metropolitan Baltimore, MD area May-June, 2015 and a Q&A followed every performance. All performances were photographed and audio and video recorded live (selections at www.lpnproductions.com). After the performance I interviewed the musician who played the Pianist character about the technical musical aspects of the recorded, improvised composition. The presented musical data here come from one of the performances selected at random. The total amount of music improvised during this performance was 71 minutes and 49 seconds long out of a total performance time of 100 minutes and 23 seconds. To reiterate, my specific experimental questions were: what effects do linguistic and visual stimuli have on improvised musical content and what can the data reveal about adaptability in the spontaneous, artistic decision-making process?

Data and Results
In Search of Dramatic Meaning: Language & Music

One clear distinction between language and music lies in their ecological functions observed in everyday life: language is explicit and conveys propositional thought while music is implicit and conveys affect.[30] Given extensive evidence for music's capacity to express and elicit emotion, experimental work determining *how* music comes to express and elicit emotion relies on the notion that "a non-trivial proportion of emotion in music can be attributed to musical structure, or…to combinations of musical features."[28] (p. 562) As such, a correlational analysis between text and musical output can offer interesting insights into what music can represent, and given the spontaneous nature of interpretation and execution, what the improvising musician chooses to represent musically in the moment (e.g. emotions, characteristics of scenographic elements). Analysis of my previous film and theatre projects revealed that the improvised music primarily created thematic congruence between sound, image and text via the combination of specific musical elements precisely to focus, enhance, and elicit a

set of emotions and particular key narrative details.[21] A review of a single performance recording from *In Session* revealed the following significant musical changes elaborated in Tables 1 through 6. Significant musical changes are defined here as moments in which the music altered in one or more ways with regards to loudness, pitch, tempo, and/or rhythm.

Table 1: Significant musical observations from Scene i. *Case Study X* with respective synopsis and partial text

- **Synopsis**: Piano enters for the first time as Therapist changes mood upon Client's request to change their topic of conversation from banality to intimacy.
- **Text**: Therapist - "*Do you mind if I add some ambient music?*..." Client - "*Yes, yes, go ahead! At least it's live…*"
- **Musical Observations**: NEUTRAL PALETTE with steady rhythm, high register, in C Major.

- **Synopsis**: Therapist pushes Client to dissect her reasons for becoming a doctor.
- **Text**: Therapist - "*...This is the first time you've mentioned an identical twin.*" Client - "*I know, I've never said anything about who she was or what she did…*"
- **Musical Observations**: SAD, DARKER TONALITY: D♭ minor arpeggio into lower register, *sostenuto* (sustained notes) within *largo* tempo (48-60 bpm), light octaves in higher register, 5th, 4th, Major 7th contrast (minor chord with Major 7th).

- **Synopsis**: Client describes freak accident that changed her identical twin sister's life and the metal half-face mask she wore thereafter.
- **Text**: Client - "*...she joked about becoming half-machine… 'These robotic faces will become a must-have item one day…'*"
- **Musical Observations**: FUTURISTIC FEEL – two-chord switch between Major third chords, two Major triads.

- **Synopsis**: Client discusses her most recent disturbing dreams.
- **Text**: "*…I find myself performing skin grafts on Sophie, leaving entire lines of faceless corpses behind. Not piles, they're literally ordered in lines…*"
- **Musical Observations**: CREEPY SETTING created by overlapping A♭ triad with A minor triad (two sets of half step tones: A♭, A + C + E♭, E).

- **Synopsis**: Therapist pushes Client to delve deeper into what makes her afraid.
- **Text**: Therapist - "*What are you afraid of?*" Client - "*Afraid of? I'm not afraid of anything.*"
- **Musical Observations**: UNSETTLING AGITATION – series of half steps rising in register, repetition of a single note while keeping the rising circular movement.

Table 2: Significant musical observations from Scene ii. *Negative Feelings Released* with synopsis and partial text

- **Synopsis**: Client encourages a reversal of roles with Therapist and a challenging of words.

- **Text**: Therapist - "*You seem upset, confused.*" Client - "*Do I? Because I think it's you who is upset, confused.*"
- **Musical Observations**: BUILDING OMINOUS AGITATION – slow tempo, low register, minor key (C). BACK & FORTH DUEL – alternating low to high registers, diminished tetrachord (group of four notes: C, D, E♭, E).

- **Synopsis**: Therapist reveals emotionally unsettling moments from her professional past.
- **Text**: "*…When you've experienced mind games of domination, rejection and humiliation you're not willing to play them anymore…*"
- **Musical Observations**: AGITATED FEEL – disjointed rhythmically, half steps and whole steps together. EMOTIONAL DISSONANCE MATCHED – alternating with B minor and C Major (C and G are not in B minor scale).

- **Synopsis**: Client is aghast that Therapist wants a new face to begin anew (e.g. career, life).
- **Text**: Client - "*…And you think a change of face will solve the problem? …there's no return route with this one.*" Therapist - "*Yes, it will solve the problem. I'm starting anew… …I don't want a return route.*"
- **Musical Observations**: INSTABILITY – no home key, *crescendo* to a forceful *fortissimo* on heavy chord.

- **Synopsis**: Client and Therapist strike a dissonant chord as Client has pulled Therapist into her clinical office and Therapist realizes the surreal nature of their encounter.
- **Text**: Therapist - "*The light above me is stage lighting.*" Client - "*…But most times we remain backstage in the dark, behind the cyclorama of focused events.*" Therapist - "*Oh for God's sake I'm not your patient!*"
- **Musical Observations**: DISSONANCE BETWEEN CHARACTERS – moving up register, alternating keys (no stable place to grab onto), increasing loudness, increasing tempo, series of half steps makes need to resolve, end on strong dissonant chord.

Table 3: Significant musical observations from Scene iii. *DSM X: Human vs. Non-human* with synopsis and partial text

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- **Synopsis**: Client recounts scene surrounding Sophie's suicide and the state of her body after the crash.
- **Text**: "*I only knew the details of what happened because she left the video recorder on…*"
- **Musical Observations**: RETURN TO SOPHIE THEME – low register, B♭ minor, left hand *ostinato*, high register octaves with D minor scale and Major 7th.

- **Synopsis**: Client remembers happy scenes with Sophie when they were children playing in Paris' public park.
- **Text**: "*When we were young we would play innocent childish tricks on couples every Sunday when we'd go to the* Bois de Boulogne…"
- **Musical Observations**: FRENCH IMPRESSIONISTIC STYLE: melancholic, use of traditional harmonic circle of 4ths and 5ths, slow arpeggiated chords, D♭ minor, D♭7 (which leads to C♯), (C♯7 to F♯ minor to B7 to E Major) A major, A♭7, D♭ minor, 6-2-5-1-4.

- **Synopsis**: Client recalls failings of her memory regarding the freak accident in the park that destroyed half of Sophie's face.
- **Text**: "*…Immediately before, immediately after, it's all a blur now. Truthfully. All I see are blotches of forms and colors…*"
- **Musical Observations**: DISTURBING FEEL WITH DARKER TONALITY – A♭ to A minor, dissonant half steps (similar to dream with skin grafts) but with more dissonance, rhythmically active, louder, faster, towards lower register.

- **Synopsis**: Client recounts scene at the hospital.
- **Text**: "*…Sophie was nowhere in sight because she was in the operating room. The nurse kept telling me how lucky I was with a few scrapes here and there… I was used to living in the hospital, but the months I spent like a patient at her side were a entirely different experience...*"
- **Musical Observations**: REFLECTING UPON ACTUAL MEMORY vs. A VISCERAL REACTION – more modal, softer and sweeter in tone (less dissonance), *lento* tempo.

- **Synopsis**: Therapist pushes Client to understand her dreams, analyze what led to Sophie's suicide, and reveal competitiveness between them.
- **Text**: Therapist - "*Do you not think that [her suicide] may be the case perhaps, of your dreams?*" Client - "*What? Causing what about my dreams? It was an accident…*" Therapist - "*Was there competition between the two of you?*" Client - "*You don't know when to stop, do you?*"
- **Musical Observations**: ANALYSIS OF DREAMS – A♭ to A minor, faster, louder, interlocking intervals (5ths, 4ths), trill on half step (dissonant interval), rising half steps in high register to mimic dreams' nebulousness).

Table 4: Significant musical observations from Scene iv.
***Terminal Illness: Existence* with synopsis and partial text**

- **Synopsis**: Silence. Client has just challenged Therapist to define her 'humanness' vs. 'robotic-ness.'
- **Text**: Client - "*…Can't you tell me what characterizes being human?...*" Therapist - "*Please! I beg you!*"
- **Musical Observations**: LONG INTRODUCTION WITH A SEARCHING QUALITY (previous intense exchange, now reassessing opinion of the other) – starts in high register, alternating direction in register, alternating arpeggios, new key centers, tempo changes between slow and fast.

- **Synopsis**: Client talks about the futileness of hope, the randomness of life, the emotions of others, the pointlessness of dreams.
- **Text**: "*…Is hope not the result of awareness, and emotion, and control? …Life amounts to circumstance.*"
- **Musical Observations**: NEUTRAL – soft volume, big open tonal Major keys, sparse combination of low held notes and soft high octaves —> slowly progresses to adding notes outside of key (e.g. A♭ (because mainly over C Major)). DREAMY, GRANDIOSE – whole tone, altered scale. Then UNSETTLING because of existential challenge – heavy touch, more notes, lower register.

Table 5: Significant musical observations from Scene v. *The nth Fall* with synopsis and partial text

- **Synopsis**: Therapist begins long richly descriptive monologue about her profession.
- **Text**: "*Oh I've questioned, and I've questioned, and I've questioned! Twenty years of questions, twenty years of stories, lives unraveled and none like this one…*"
- **Musical Observations**: REFLECTIVE, PENSIVE – high register, bell tones (4th stacked on each other, B♭ Major scale, but more F sus/dominant, C minor pentatonic), series of lightly arpeggiated groupings (4 to 5 notes), chords descending in B♭ Major scale.

- **Synopsis**: Therapist lists her different clients by their most characteristic psychological features.
- **Text**: "*The drama with the mistresses, the secrecy of a lover, the gambling addict, the sibling rivalry, the agoraphobic, the jealous friendship, the obsessive compulsive, the deviant in all respects… I wonder about those intimate stories, the absolute trust conferred on me…*"
- **Musical Observations**: LISTING DIFFERENCES, STEP-LIKE – G minor, alternating half steps, descending arpeggios in different keys, repeating slow trills with small *crescendo* and *decrescendo* as self-questioning settles in.

- **Synopsis**: Therapist acknowledges her initial lofty ideals and goals, and then the simpler ones.
- **Text**: "*And that's why I joined this whole affair… to make some sort of difference in the world… I was okay with helping people fight their lustful, lonely, lying demons…*"
- **Musical Observations**: SEARCHING QUALITY – softly floating across keys, Major key then shifts to minor key.

- **Synopsis**: Therapist relates her past as a dissatisfied art historian deciding to turn to psychotherapy to understand how creativity arises.
- **Text**: "*…How many minds could I affect? It wasn't going to happen studying the like of Botticelli, … But if I heard the stories from the very storyteller him or herself maybe I could see the process of creativity unfold, maybe I could capture the unraveling personality in real-time… Society has a warped way of praising extraordinary minds after the fact…*"
- **Musical Observations**: POTENTIAL POSSIBILITIES – Major tonality; alternation between notes, then shift to French Impressionistic style. NOBLE HOPES MIRED BY REALITY – ends on another chord not in previous key to punctuate CONCEPTUAL DISSONANCE.

- **Synopsis**: Therapist begins tale about her first client as a psychotherapist.
- **Text**: "*So I left that tunnel of a world… Then I entered an entirely different tunnel. It all started with my first client, a young adult who had been mistreated as a child and was completely lost in life. … He was with me for eight years… Every year was marked by slow but extraordinary improvement. … I even remember when he opened up a snazzy lounge in a renovated warehouse. … You could say he had found himself. Except a year later, … everything collapsed…*"
- **Musical Observations**: BACK & FORTH REMEMBERING – D minor to F minor to A♭ Major, interlocking intervals, parallel thirds move into a lounge-like jazzy-blues lick. Then COLLAPSE, DARKER TOUCH – A♭ Major to A♭ minor, cascade into lower register.

- **Synopsis**: Therapist details her memory of the evening in Paris when she saw her client.
- **Text**: "*I was in Paris… it was early one evening as I was on my way to meet some friends for drinks… I decided not to take the metro and walk, walk along the* Quai d'Orsay *through the* Quai Anatole France. *It was a beautiful evening. The sun had just set, the weather was cool and crisp, the streets were as busy as usual…*"
- **Musical Observations**: REMINISCING YET SLIGHTLY SUSPENSEFUL – changing a lot between modes: sometimes A Major, mostly minor key, lighter, higher register, chords are tonal, shifting from A minor to C Major -taking everything in and then focus- with specific build up on E7 (fifth of A minor) - sequence of notes converging to this chord to lead to A minor.

- **Synopsis**: Therapist details moment upon seeing client.
- **Text**: "*… So I took a moment and stood there against the stonewall of the* Pont Royal *and absorbed everything: the smell of autumn, the people passing by, the water below, the rows of glowing lights. And with one random glance I saw him. … on the other side of the bridge, as if waiting, waiting for me. Our eyes met. We instantly recognized each other and smiled. I felt compelled to walk towards him, … but it's as if he'd read my mind and instead he shook his head in disapproval…*"
- **Musical Observations**: DIRGE-LIKE while shifting towards Paris theme with *Ne me quitte pas* melody – minimal accompaniment under melody, *largo* tempo with delicate, tender touch.

- **Synopsis**: Therapist details the moment she looses sight of her client and havoc ensues.
- **Text**: "*I checked my watch, I was already running late, and just as I was about to wave goodbye, a man looking through his viewfinder while taking pictures backed into me. He apologized and then I heard a scream, an Edvard Munch kind of scream. I immediately looked back at my client on the other side of the bridge. He was gone. I looked everywhere, crossing the* Pont Royal *to where he had been standing. …When I got there I saw the book he had kissed, it had fallen to the ground. …I picked it up. It was Camus'* La Chute. *And then I remembered: I had recommended several of Camus' writings to him about three years into therapy. …I looked down at the water where everyone was pointing and taking pictures… And then I realized what I had witnessed: la chute had always been his fall.*"
- **Musical Observations**: CONTEMPLATIVE, MATCHING PHYSICAL & MENTAL CHARACTERISTICS OF EACH EVENT – *Ne me quitte pas* melody continues. 5, 6, 7, 1, (still A minor), tempo slightly speeds up as if desperate, more rhythmic motion, more notes (more accompaniment) until 'book falling to ground': arpeggio on E7 going up and then down, goes into Major key (recommending Camus' writings is a positive action). Then 'look down at water': progression towards resolving to A minor leads into lower register, heavier chords (volume, more notes, minor, one chord with fifths).

- **Synopsis**: Therapist's realization of client's suicide plan.
- **Text**: "…*He had written out in exquisite detail his entire plan: from the very beginning of his nascent obsession with the novel and every event within it, to the very end of how he had followed me to Paris, found out where I was speaking, tracked my movements, and waited for that vey moment I witnessed to complete his final deed. And the man who ran into me? I don't know, I don't know if that was a mere coincidence or not… Perhaps it was the one perfectly random moment he had hoped for,* waited *for, to make the jump.*"
- **Musical Observations**: FINDING ANSWERS THAT LEAD TO CLIENT'S RESOLUTION – still with *Ne me quitte pas* melody, E7 arpeggio up and down, spirals down to lower register, *crescendo-decrescendo*, and closes with sequence A minor to D minor to A minor (1, 4, 1) to resolve right as Client ultimately resolves to jump.

- **Synopsis**: Therapist searches for answers.
- **Text**: "*I finally made it to the* Place Vendôme *column… My friends were still there; they had created an impromptu photo-shoot Helmut Newton-style… I, on the other hand, was in another world. I couldn't stop seeing his impenetrable stare. …Every time I repeated those images I zoomed in closer, the blown-up image grainier and grainier, but I kept zooming in. And it was in one of those zooms when I realized… he had waited, waited for him to collide with me to jump*…"
- **Musical Observations**: Shifts to Major key center -talking about friends, images and zooming in- alternating interlocking intervals between 1, 5, 1 (A minor to E7 to A minor). Concludes with louder, lower register, still interlocking chord sequence to mirror Therapist's SEARCHING & MAGNIFYING TONE.

- **Synopsis**: Pause before recounting events after suicide.
- **Text**: "*Days after the incident I questioned everything: my* role *as a therapist, my* ability *as a therapist. It didn't matter that I had a handful of clients and that I was in my ninth, almost tenth year in the business and everyone was visibly improving… and recommending me to their friends! I was distraught; utterly devastated. I went back to my office and reread through all eight years of notes I had taken during his sessions and searched for a word, a phrase, an* event *that might reveal* something *I may have overlooked*…"
- **Musical Observations**: BREATHING SLOWLY – octaves in high register. Jump was dark, heavy, and in minor tone. Now aftermath is to refocus audience on new section, briefly in Major key, but then UTTER DEVASTATION via dissonant chords ascending into high register.

- **Synopsis**: Therapist desperately searches for answers.
- **Text**: "*I had become the obsessive compulsive and I didn't find anything. I sketched out his entire story in a diagram … But there were no factual inconsistencies, no bursts of negativity or signs of regression, no new, past, extraordinary or outrageous events that could trigger a downward reaction. When you see someone transform from complete listlessness with zero, zero achievement to the epitome of energy as an active creator you can't accept such a suicide as real. And you certainly can't see what mistakes* you *may have made; mistakes in judgment, mistakes in perception*…"
- **Musical Observations**: SENSE OF OBSESSIVE COMPULSIVENESS – repeated rhythmic figures

(highlighting instability), still in A minor, E7 to A minor. Reprise of *Ne me quitte pas*. Pedal of A minor with all chords over top of it; arpeggio E7 until higher register, very high. Resolves to A minor, with very low A pedals to create resolution to whole sequence. Slow *decrescendo*.

Table 6: Significant musical observations from Scene vi.
Farewell At Last **with synopsis and partial text**

- **Synopsis**: Therapist tries upending Client's previous nihilistic tone and aggressive questioning.
- **Text**: Therapist - "*Did your sister commit suicide out of her own free will? Or did you encourage her to do so?*" Client - "*Did I kill her, you mean?*"
- **Musical Observations**: UNSETTLED TONE BETWEEN CHARACTERS – icy, dissonant chord in high register.

- **Synopsis**: Client probes Therapist further.
- **Text**: Therapist - "*No. I haven't said anything about killing anyone.*" Client - "*The implication is there.*" Therapist - "*It is not.*" Client - "*Why do you ask?*" Therapist - "*I don't know. Out of mere curiosity. I just realized that we never dissected the situation.*" Client - "*Dissected the situation? There's nothing to dissect!*" Therapist - "*Of course not.*"
- **Musical Observations**: MIRRORING BACK & FORTH STINGING RESPONSES: dissonant, *pianissimo* dynamics, single notes, high register, low register, high register, then downwards into lower register.

- **Synopsis**: Tension continues between Client and Therapist.
- **Text**: Client - "*What if I had encouraged her towards suicide?*" Therapist - "*Have you been sitting on a guilty conscious this entire time?... Of course, assuming I had enough evidence of the truth, it's a good ethical dilemma: to blow or not to blow the whistle on the culpable in plain sight. Is it even a balance worth testing? Betray confidentiality for the justice of the victim… Or ignore in honor of client confidentiality… Why do you ask?*" Client - "*Oh no reason. Out of mere curiosity.*"
- **Musical Observations**: Major 7th intervals (dissonant), repeated note sequence ('guilty conscious'). A♭ to A minor: return to creepy dream sequence. High register dissonance, back and forth with a lot of space and then less space between notes.

- **Synopsis**: Therapist slowly recognizing self-doubt.
- **Text**: "*Look, I'll be frank with you. I didn't expect we'd arrive at this. And the truth is that I've no idea what has happened between us all this time. I… I've had an entirely different experience with you than I've ever had with a client. But we realized there are many problems to solve.*"
- **Musical Observations**: DISGUSTED BUT REMAINING PROFESSIONAL – slow, sequence of minor chords.

- **Synopsis**: Client questions their awareness of self.
- **Text**: Client - "*…You almost sound like a computer on loop.*" Therapist - "*A computer on loop? Is that what you think a therapist is? That I'm the robot!?*" Client - "*No, by no means a robot. I apologize. I didn't mean it in any derogatory sense. But please, tell me, why are we so afraid of the mind!? Aren't we just fancy reactors to stimuli? We're… we're what?*"

Complex organic systems with innate modules waiting to be exercised and malleable masses of stored information? The problem is we know we are. And!? What does our awareness afford us when we don't even understand what this awareness is?..." Therapist - "*Right as we stand at the entrance of this tunnel of self-torture, to conclude that we don't know. Again? You ask me these questions?...*"
- **Musical Observations**: FUTURISTIC TONE – trill with half steps, short dissonant chords. JARRING augmented scale followed by descending series of half steps (half step pairs separated by 3rds). Major chords separated by Major thirds – futuristic questions: minor chords, D♭ minor (coming from A♭, 5th from D♭ minor), RESOLUTION to F♯ minor in low register with high sequence of 8th notes to highlight both that it is time to end yet there is remaining UNCERTAINTY with the ensuing questioning of self.

- **Synopsis**: Therapist attempts to end conversation quickly.
- **Text**: Therapist - "*…I hate to sound so cliché, and I realize that very phrase is cliché, but your success is mine. This was always a group effort.*" Client - "*Yes, of course, I know. Do you stay in touch with clients who've finished, so-to-speak, with you?*"
- **Musical Observations**: UNSETTLING EFFECT – low note pedal with sequence of moving triads in no particular key. Then arpeggio down from high to lower register and back to F♯ minor resolution.

- **Synopsis**: Client annoys Therapist with more questions.
- **Text**: Therapist - "*'So is this it?,' you're asking? Do I walk out the door and never see you again?*" Client - "*Do you? Is this the next step?*" Therapist - "*That's how it typically goes. The ultimate goal is to walk out and never return. That's what a success story is…*"
- **Musical Observations**: More pauses, RESOLUTION UNKNOWN – fast trill dissonant half steps and triads in no particular key (heightens instability).

- **Synopsis**: Client latches onto Therapist's insecurities.
- **Text**: Client - "*…Aren't you tired of all this? Hearing my story, others' stories? I can't read your mind.*" Therapist - "*Why do we always say we can't "read each others' minds?" Of course we can! We reveal what we're thinking, what we want with our actions.*"
- **Musical Observations**: FUTURISTIC TOUCH – two Major triads separated by Major thirds (F and A). AMBIGUITY – A minor to A♭ alternation.

- **Synopsis**: Therapist remains professional despite emotional breakdown.
- **Text**: Client - "*Well, I must be going then, long days ahead. I suppose I shall see you when I see you.*" Therapist - "*Yes, of course! Let me at least walk you out.*"
- **Musical Observations**: UNRESOLVED MATTERS, MENTAL TURMOIL EVIDENT – long arpeggio, rhythmic pattern, fast-slow tempi, high dissonant chords. Arpeggio to high register, rhythmic sequence of 2,3 notes fast then slow tempo. E, F, A♭, A, C (as half notes).

- **Synopsis**: With locked gazes and Client's back to audience, Therapist walks Client to door.

- **Musical Observations**: *Ostinato* in right hand, while left plays octaves (same notes); starts in low register and moves up. E7♭9 sequence, shifted to F♯ minor, descending whole steps ascending in register (repeated twice for INTENSITY).

- **Synopsis**: Therapist prepares to leave office.
- **Musical Observations**: SHIFTING THROUGH BOOKS, CONTEMPLATION OF DIARY'S MEANING & INNER EMOTIONAL TURMOIL – D♭ half whole scale, alternating between F♯ minor and D♭7. Swells of volume changes, high register, repeated octave notes: F♯ pedal (sustained tone) and quick right hand rising and falling scalar passage; resolving 5 1, 5 1 (F♯ minor and C♯7), faster rhythmically, then slower, louder-softer volume, higher-lower register. End with emphatic final descending sequence via series of half steps separated by a third.

Discussion

In describing what music is essentially capable of expressing, composer and philosopher Leonard B. Meyer writes: "Music does not, for example, present the concept or image of death itself. Rather it connotes that rich realm of experience in which death and darkness, night and cold, winter and sleep and silence are all combined and consolidated into a single connotative complex… which then becomes particularized in the experience of the individual listener."[31] (p. 265) So what does this mean for the current study? Just as particular sounds combine to have shared and learned meaning in natural language, music too, albeit not as semantically specific, has a similar capability. Breaking down Meyer's example, if death has a set of universal physical characteristics, e.g. collapse, stillness, and silence, then combining musical variables (e.g. rhythm, tempo, and loudness) in any number of ways can onomatopoeically mimic those recognizable physical features and consequently elicit an image of death in the listener. Music, given its lack of semantic specificity, then, functions as a communicative medium expressing concepts and emotions via connotative representations. Philosopher Peter Kivy further posits that music's expressiveness results because "various features of music, such as tempo, mode, and melodic patterns, display a "structural resemblance" with features of human behavior [such as vocal and bodily expression] that are expressive of [specific] emotions."[32] (p. 129)

In the case where language is present and immensely rich and actors enact the emotional content on stage, as in the theatrical play *In Session* discussed, improvised music takes on an immediate, particularly enhancing role. The data from this study illustrate musical moments created during live dramatic discourse and, as shown in the above Tables 1 through 6, reveal the following: (1) music helps to create a single, overarching emotional percept (and I will go as far as to posit one that 'summarizes' the overall emotional context), (2) particular musical variables and consequent musical sequences are explicitly chosen and elaborated upon by the musician to mimic physical characteristics identified within the scene's narrative –in this case, pivotal consequent mental states, and (3) musical variables that "match" the physical characteristic(s) identified are combined and recombined to continually create novel sequences. All three elements unify in the moment to form a seamless, coherent artistic work as perceived by the audience. Spontaneous musical improvisation in theatre of this kind, therefore, essentially entails unifying identified main

concepts explored via natural language along with physical, scenic features into a general, universal emotional target which is then translated into musical language (see Figure 3).
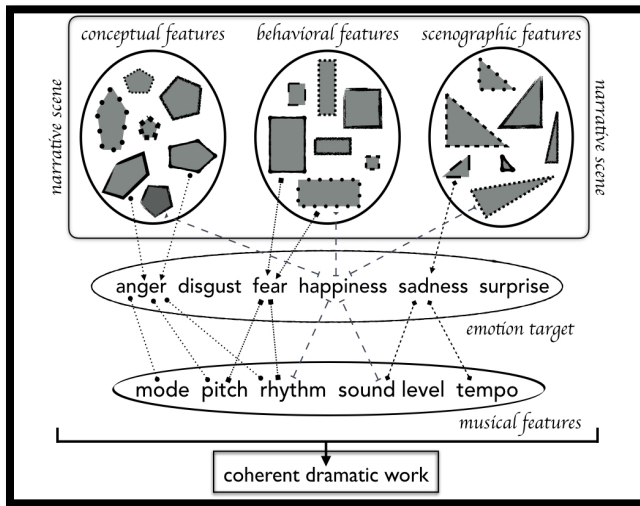

Figure 3. Schematic drawing of the elements that lead to a live, coherent dramatic work in the context of live, improvised music within theatre. In the case of a theatrical production, there are various features that create a narrative scene: conceptual features introduced by the characters' discourse that can take on any number of forms, behavioral features expressed by the actors that can take on any number of forms, and scenographic features on stage that can take on any number of forms. A musician tasked with improvising a soundtrack during the production immediately identifies a general emotion target (the six universal human emotions listed for purposes of simplification) from the array of features occurring and creates a musical sequence that mimics recognizable, physical features from the selected emotion. The ensuing result is an unfolding seamless, dramatic work.

The significance of this study is three-fold. Firstly, I note the novelty of this theatrical production and study of such in both the theatrical and experimental science worlds. The inclusion of an improvising musician on stage during the entirety of an intense two-character play (specifically written for improvised musical accompaniment) is a rarity in both contemporary theatre and contemporary free improvisation music events, and this second theatrical work continues to challenge both the very nature of science writing and what dramatic script writing entails with regards to how language, action, and emotion can be represented on stage and then turned on its head for analysis. Furthermore, the experimental structure of such a dramatic script and the resulting artistic object, or data, is an innovation within the field of cognitive psychology. No study (apart from the research program I have initiated with La Petite Noiseuse Productions between musical improvisation, film, and theatre), to my knowledge, has so brazenly intertwined methods and data from both the Arts and the Sciences to redefine what Art and Science are as disciplines of truth-searching and to begin to fully understand the nuances of live, spontaneous creativity simply not possible in the traditional psychology laboratory setting or even the newer magnetic resonance imaging space.

Secondly, I argue that this live theatrical context functions as a novel, realistic framework from which to study in-the-moment spontaneous, behavioral adaptability. Cognitive flexibility and an ability to adapt to new environmental conditions are paramount for problem solving and creative output. Improvising music to "fit" continuous lines of rich dialogue is a highly complex task that entails acute sensitivity to the unfolding environmental context

(itself hugely multisensory), identification of important (narrative) features, and immediate translation of these features, using a limited set of tools/constraints, into an universal representation that is both concise and novel at every instance. This spontaneous and *laissez-faire* setup thus offers a highly unique window in which to observe, understand, and ultimately model the creative process in action.

Finally, given both the richness of this type of data and the paucity of this type of investigation, I emphasize the underrepresented value the study of natural language, music, and live performance art has within the research domain of human creative cognition and advocate for its inclusion and support.

Conclusions

> "I thought that if they [the Robots] were more like us they would understand us better. That they couldn't hate us if they were only a little more human," (p. 72)

frantically explains Karel Čapek's Helena Glory, President of the Humanity League, to Harry Domin, General Manager of the island factory of Rossum's Universal Robots (RUR), as to why she asked Dr. Gall, Head of the Physiological Department of RUR, to alter the internal physiological makeup of the factory's new batch of robots who now threaten humans' existence.[33] Almost a century later we are in an intellectual dilemma similar to Helena's world on stage in 1920: we want our intelligent machines to be like ourselves, complete with awareness, emotion perception, desires and consequent actions, and creative capacity. The solution today, as in *RUR* and as similarly discussed by artist and philosopher Paul Ziff in 1959,[34] is obvious: simply change the machine's hardware to match our neural circuitry and *voilà*, fabrication of human artificial intelligence resolved… perhaps. Yet the actual implementation of such a solution still remains elusive; difficult to pin down because we are a complex species who is both self and socially-aware, self-improving, and goal-seeking and the near future wave of human-like artificial systems depend on us knowing exactly how we perceive, think, feel, and act.

To perceive, think, feel, and act are capacities we take for granted in our everyday lives. Take for example four phenomena that characterize our cognitive architecture and are integral to our survival: consciousness, object recognition and scene analysis, language (and musical) comprehension and production, and emotion perception/expression. It is impossible to imagine a world without our capacity to have subjective and sentient experiences as we seamlessly interpret and navigate through a maze of animals, objects, people, and places and effortlessly interact and communicate with each other via a plethora of integrated audio-visual-tactile-olfactory means. There is no doubt that digital computers, as *RUR*'s Robots did on stage, have outpaced us with their processing speed and memory capacity. But as critically noted by psychologist Gary Marcus and philosopher John R. Searle, two key ingredients still need to be spelled out in order to come to a complete understanding of human cognition: how exactly do individual neural circuits and consequent groups of neural networks carry out mental representations and computations[35] and how does consciousness at the neurobiological level factor into perception, memory, and goal-directed action.[36] The game is on as more recent competitive developments in computer vision have yielded models capable of generating simple, human-like descriptive natural language sentences to images and their surrounding scenic contexts,[37] a basic yet essential feat necessary to working up the ladder of human cognition. AI

scientist Fei-Fei Li further remarks that the next step is indeed to "build the cognitive capability we need in fundamental vision tasks like understanding scenes, human behaviors, and relationships, and reasoning and telling stories."[38] And it is this particular goal of AI to eventually 'tell stories' that is at the very crux of my research here: if we can accurately model the storytelling process unfolding in a multisensory context as the one within live theatre described here, we can successfully move forward with more personalized and intelligent online search engines and beyond.

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