Using SocialXR to Measure Social Cognitive Performance to Address Isolation Associated with Deployment and Post-Traumatic Life Events

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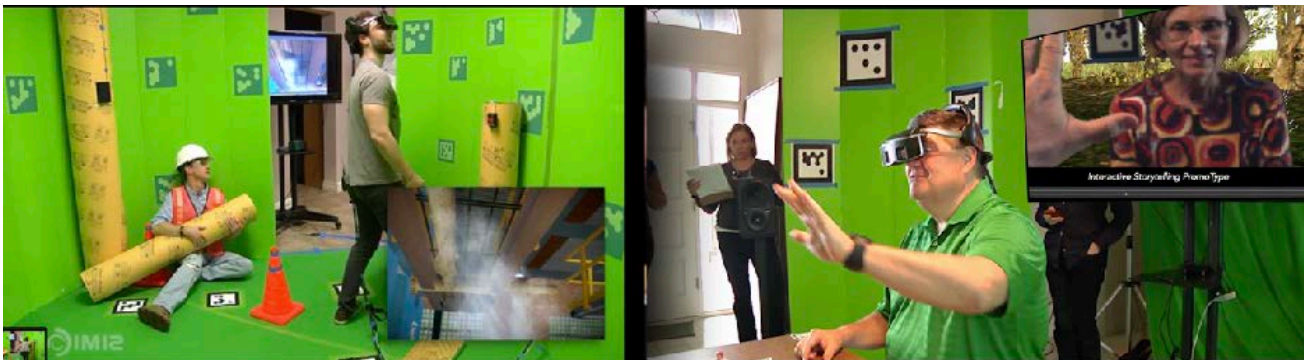
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Figure 1: SocialXR measuring social cognitive performance in Aphasia Therapy (right) and simulating human experience modeling to manufacturing design and emergency response (left).

ABSTRACT: THE NEED FOR QUANTIFYING SOCIALITY

In the wake of 2020's pandemic, the need to develop new methods and coping strategies to preserve the social cohesion and psychological resilience of communities around the world clearly emerged as a priority. We call this social-cognitive behavior, "Sociality." Sociality is our ability to efficiently function both as individuals and as a part of a wider group despite external limitations that become even more meaningful in critical settings like military interventions, non-military operations like emergency response, ICU health operators, flight attendants, and deep space explorations. Unique features of digital technologies such as Social XR [1] represent an opportunity to target these needs and deploy scalable and flexible solutions to promote internal team stability and better operational performances.

A pre-requisite to design and deploy mentally and socially sustainable operations, both in military and non-military settings, is selecting individuals with resilient profiles and provide them with a cooperational framework ensuring balanced relationships and quality inter-personal communication [2]. Social cohesion emerges as an essential factor for the success of planned operations, and the ability to monitor, detect and predict its effectiveness in time is meaningful to manage the potential behavioral anomalies. The study of group dynamics occurring within target teams, and with mission control, can provide critical and early cues to encourage constructive exchanges and discourage critical relational patterns [3].

The present project focuses on presenting a technology-enabled approach to group dynamics able to remotely and autonomously capture the complexity of human interactions and return actionable insights useful to prevent and manage individual and group behavioral anomalies [4]. The complexity of group's interactions requires an array of human Subject Matter Expertise (SME) to observe, evaluate, measure, assess, predict,

prevent and apply necessary countermeasures [5]. In real world, it is impractical to have this expanse team of practitioners to be on call or in situ in providing constant monitoring of mission teams. Technological support systems, as the one described in this paper, would enhance the process providing remote operating software-based tools to help expert assessment and self-efficacy to sustaining social cohesion. An automated, embedded system that is operated remotely would provide constant measurement and evaluation to identify the subtle and nuanced social fragility metrics. This would provide economy in time and resources in providing unobtrusive preventative measures aimed at improving team performance, minimize risks and increase the probability of mission's success.

The research framework is based on preliminary studies conducted on diverse populations at high-risk of isolation. Technology interfaces such as AR Head Mounted Displays (HMD) have been used to collect first person perspective during inter-personal group interactions, then resulting data have been followed by human professional evaluation of quantified insights (Figure 1). Eventually, machine learning algorithms have been applied to aggregate both human observation and perceptual computing to validate engagement techniques and plan optimal countermeasures [6]. The resulting human-machine interaction model suggests the opportunity to develop a delocalized and asynchronous social support system suitable to perform whenever and wherever needed, with human evaluation expected to reduce in time thanks to the growing autonomy of the system.
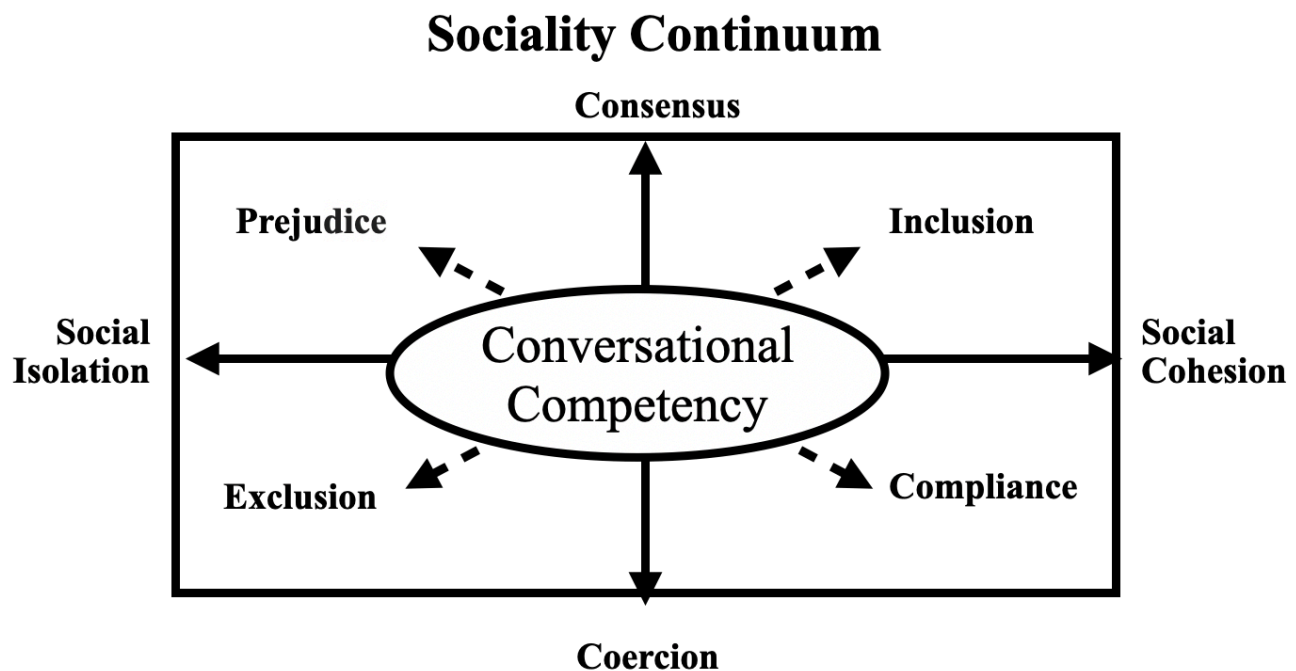

Figure 2: Sociality assessment framework measuring conversational competency that can escalating or de-escalating social cohesion across a spectrum mapped to diverse social cognitive behavior.

1.0   PREFACE: THE FRAGILITY OF SOCIALITY

As a social species, we depend upon on our communication to strengthen the fragility of our sociality and avoid isolating behavior. Maintaining sociality is not just an individual problem or an issue for society at large. Sociality is everybody's responsibility that is challenged in the conversation with any workgroup, family or social encounter. The quality of human connection and social engagement is tied to our choices of words and communication media that we use to convey our feelings and intent. Where it can take a years to build trust in

relationships, one encounter can emotionally sever connections that took years to build dismantling the fabric of a community. Conversational competency is central to social cohesion and considered by many as "the most important skill that we are never taught." As social media has increased our connection it has enhance social cohesion as much as it contributes to socially isolating results.

In responding to the global pandemic, quarantining has forced us to converse remotely, which has tested everybody's quality of conversational competency to overcome limitations of social media. Socially volatile environment of politics and social unrest has only amplified the challenge to maintain sociality that can range from social cohesion through inclusion or compliance or social isolation through prejudice or exclusion (Figure 2). However, this has always been a concern with military personnel in deployment in foreign service and with veterans returning to society from traumatic life events such as with disability. This mental health issue has become more prevalent with COVId-19 and more urgent to address.

Unchecked, the deterioration of sociality can lead to more adverse impacts of isolation that can lead to poor performance, depression, ill-health and even suicidality. Military positions are listed in three of the top ten positions likely to divorce. Depression is five times more for active duty military than that of civilans[1]. Military suicides are four times that of deaths in war operation since 9/11[2]. This statistic is 150% more than that of non-veterans and loneliness is a major determinant in these statistics.
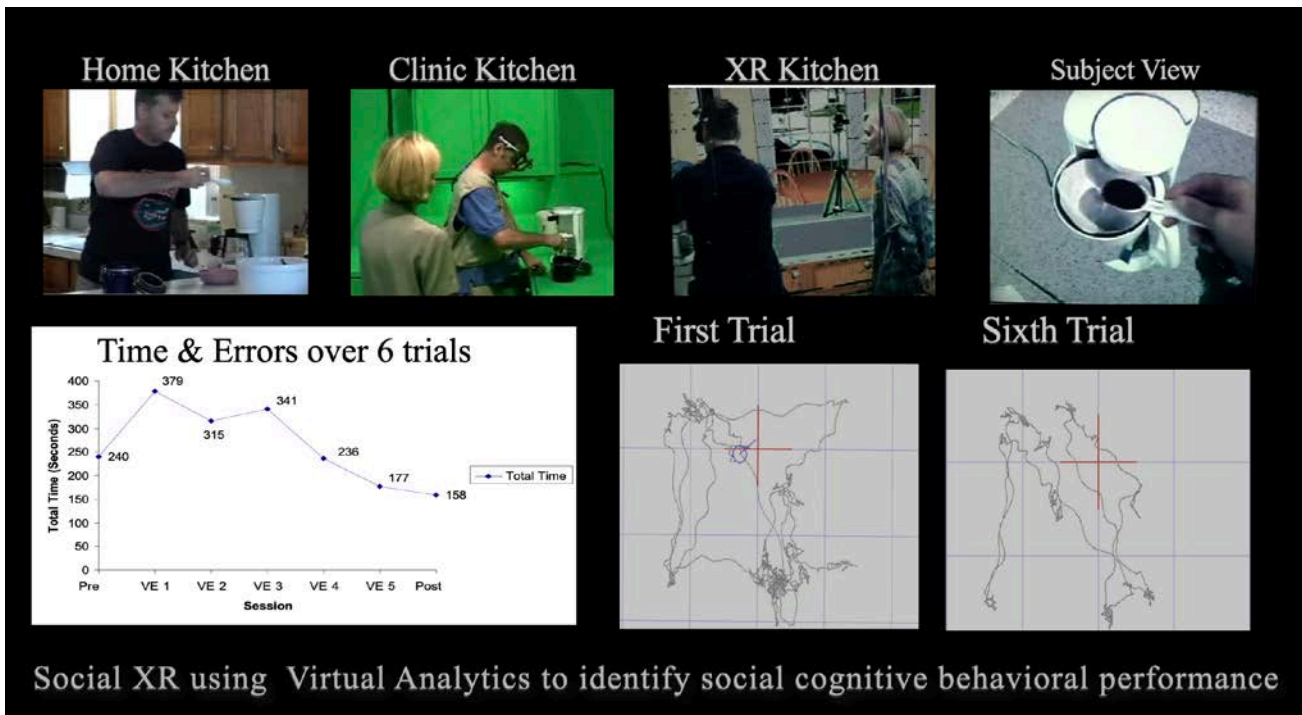

Figure 3: Cognitive rehabilitation of Traumatic Brain Injury (TBI) subject using SocialXR to stimulate occupational therapy and measure cognitive behavior assisted by the social engagement of therapist and family members to stimulate social learning.

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[1] https://www.healthaffairs.org/do/10.1377/hblog20200130.419838/full/

[2] https://www.npr.org/2021/06/24/1009846329/military-suicides-deaths-mental-health-crisis

We have worked with Subect Matter Experts (SME) that service populations at high risk of social isolation to examine how we can measure sociality to help validate innovative approaches to conversational competency through coaching, therapy and rehabilitation with families and workgroups. Validation of novel techniques require new methods and measures embedded in spatial computing to aggregate machine intelligence with human reasoning to screen, train, monitor, correct and rehabilitate sociality. These measures will inform how we can improve our social media practices and technology.

2.0 INTRODUCTION: SOCIALXR AND MEASURING SOCIAL COHESION

Social eXtended Reality (SocialXR) integrates spatial computing (virtuality) with the mapping of human relationships and sociality using perceptual computing. This allows us to track a subject's social cognitive performance that can improve insights for diverse Subject Matter Experts (SME) such as therapists and pathologists to tag and recommend corrective frameworks. Typically in tracking social cognitive behavior, there are certain limits with self-assessment as well with the single analogical observations of the SME. These challenges can be overcome with the precision of perceptual computing automating the analysis of behavior within the recognition of speech, gestures, expressions and focused attention. The aggregation of objective, quantitative measures collected automatically via computer helps validates the subjective, qualitative data registered by the SME's experienced observations and human reasoning. Aggregating evidence based data over a variety of applications fills a critical gap in helping SMEs to provide efficacy for innovative treatments that can screen and monitor mental health and social resilience before deployment and after treatment.

Our investigation suggests the need for an innovative and more robust method of measuring the subtle nuance of "Sociality" within a more complex group interaction and across the diversity of settings a community can occupy. Using SocialXR to augment SMEs assessment, provides an improved monitoring of sociality that produces exponentially more data that is required to be processed in real-time.

Figure 4: Capturing 360 stereo video of group interaction collaborating on a single task and viewed above as a group and simultaneously face-to-face for individual evaluation of perceptual computing of verbal and non-verbal capture.

With previous research, Virtual Reality (VR) has been able to provide several successful therapy solutions for mental health including VR distraction therapy for pain and VR exposure therapy for PTSd. By using SocialXR, we are integrating the context of physical places and people into the virtual simulation. The technology registers the real world with the virtual worlds that can perceive and track the user's visual and audio cues to model their human social interaction for analysis. With machine learning, these cues of social cognitive behavior can be automatically captured and analyzed assessing the complexity between larger group participation with each individual's verbal and non-verbal communication. This is near impossible and inefficient for humans to accurately capture. By SMEs annotating this automated capture of escalation or de-escalation of sociality, we can test and evaluate causality and novel interventions and compare computer analytics with human reasoning to validate with evidence-based data to safely adopt more widely to other therapy, rehabilitation or educational applications.
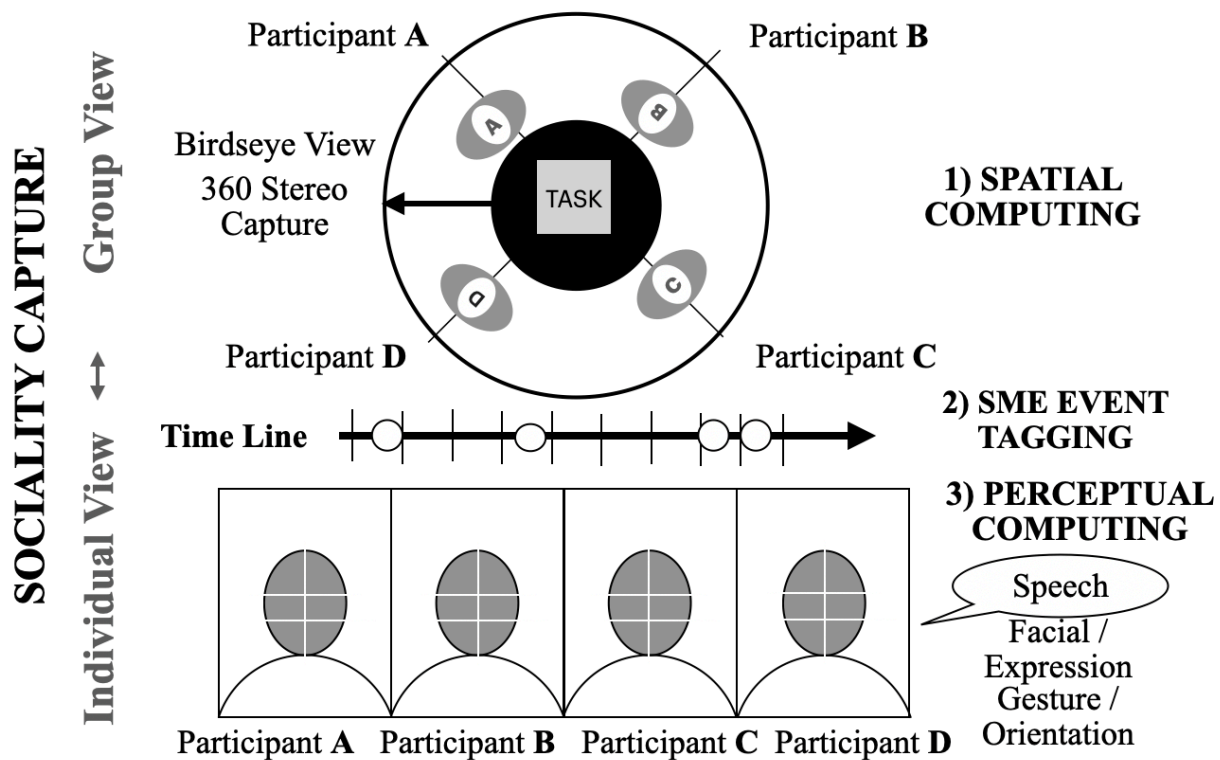

Figure 5: A single 360 degree capture of group interaction collaborating on a single task is assessed from above as a group with spatial computing and simultaneously face-to-face for individual evaluation with perceptual computing. This captures the nuanced and complexity of conversation over time.

2.1   Experience Capture of Sociality

We are using 360 degree stereo video to spatially capture (Figure 4) and map out relationships and interpersonal transactions we can signal the escalating or de-escalating sociality (figure 5). We have deployed this method within community centers servicing populations at high risk of isolation. This requires the ability to aggregate a variety of data formats from diverse subjects, applications that are reviewed by cross-disciplinary experts for examination. We leverage data virtualization techniques so non-statisticians can identify meaningful patterns in the datasets as well as compare with related treatment practices. This will be able to define a common measure and methodology that can be applied across communities to help define a common human

assessment across a variety of applications. To scale the operation of data collection, we are working with readily available consumer technology that will be both nonintrusive and easy accessible to collect and upload data at scale for a research repository.

The technical challenge in building our system is to accurately see what the SME sees and automate the process of SME's tagging and categorization of events in the audio/visual media. This takes three key technologies of *stereo 360 degree cameras*, *perceptual computing* and *machine learning:*

1) Spatial Mapping with Stereo 360 degree Cameras:

The central position of a stereo 360 degree camera provides critical views for human and computer analysis. From the point of view of the task-at-hand (center of conference table), the camera provides both a Birdseye view (Figure 4 right) of the group as well as a direct face-to-face view of each participant (Figure 4 left). The stereo view provides a more intimate and detailed observation with depth-perception and provides a sense of acute presence for the SME to intuit the participant's performance.

2) Tagging Sociality Cues with Perceptual Computing:

With the face-to-face capture, SMEs can tag significant events that contribute to the sociality of the social engagement. The SME can use experienced based knowledge to tag relevant cues, stages and states that each participant achieves in their session. Perceptual computing will capture speech and facial recognition as well as body language to track their orientation, attention and non-verbal communication. SME tagging will be linked to perceptual computing cues to automate a larger number of samples.

3) Automating data Capture with Machine Learning:

With machine learning, diverse data will be aggregated to find correlation between the precision of computer measure and the insight of human meaning. With sufficient iterations, this process will automate a larger volume of sessions to provide human experience modeling integrating both machine and human intelligence for a result that is more than the sum of the parts.

2.2   SocialXR Immersive Collaborative Testbed

With sufficient spatial computing and data virtualization, leading experts around the world can view a persistent, interactive 3d data repository in an online SocialXR platform. The access to this immersive, online peer review and collaboration system, it will improve protocols for evaluating social cognitive performance across disciplines, practices and sectors. With a broader access and utilization, more powerful tools can be created to specialize in supporting each critical population at high risk of isolation. With core technologies and diverse applications, smaller communities and centers can leverage their existing technology to service more professional practices to enhance sociality and address the epidemic of isolation at the earliest stages for support or intervention.

2.3   Developing Innovative Methods and Measure

With our data capture, analysis and reporting method, we will be able to amass the critical evidence based data to validate successful prototypes for sociality assessment. The critical data would be collected in three parts: 1) linguistic communication, 2) behavioral responses and 3) Conversational Performance. Each of these categories are captured by the SME's post analysis or perceptual computing using standard programs recognizing speech, gesture, body orientation and facial expressions. SMEs would tag significant events they

observed during the course of the activity with subjective and qualitative measures. These would be crossed reference with the objective, quantitative perceptual computing.

A) *Linguistic Communication*: Speech recognition will be captured and analyzed to track the increase sophistication of language use with social cognitive performance. The story creation process will be able to track and measure narrative structure and tendency as well as the level of creativity and empathy employed by participants, highlighting parameters such as:

* Utterances

* Words

* Sentences

* Complete thoughts

* Story Creation

B) *Behavioral Responses:* Computer audio/vision will use perceptional computing to capture the non-verbal body language to study the level of human connection and social engagement with real, virtual or fictional entities.

* Emotive response

* gestural communication

* Orientation

* Focus and gaze

* Artifact handling

C) *Conversational Performance:* Automation of SME observations will be tracking sophistication of participant's conversation competency and expressive command.

* Initiation of conversation

* Conversational response

* Scaffolding of concepts

* Verbal inflection

* Level of interaction

* Escalation of InterPlay engagement strategies

With the same baseline experiences being evaluated, diverse subjects and SMEs can be cross-referenced to find common patterns, variations or deviation. The use of pre and post tests will use evaluation protocols used in standard practice to find maximum relevance between each application area.

Our preliminary studies and expert reviews, suggest there is a game-changing opportunity to more rapidly innovate practices to improve sociality.

This would require the process be aligned with international or national databanks integrating corresponding protocols for social, cognitive and emotional assessment. The development of a comprehensive framework and methodology, conversational captures of group collaboration can become a persistent, reusable and interoperable testbed for sociality. Current assessment repositories under review are Carnegie Mellon's Aphasia Bank, Aphasia Access Life Participation Approach to Aphasia (LPAA), The Collaboration of Aphasia Trialists CATS) and the NIH Tool Box for the Assessment of Neurological and Behavioral Function.

3.0   APHASIA CASE: SOCIAL RESILIENCY AFTER TRAUMATIC EVENTS

Imagine waking up after a Traumatic Brain Injury (TBI) on the battlefield or a stroke at the kitchen table. When you try to talk, nobody can understand what you were saying and you would not understand anybody else. This may be the first time you learned about Aphasia, which is the loss of language due to a stroke or head injury. You would not be able to enter into Aphasia therapy or rehabilitation for another 6 months. In the meantime, you would be isolated within your own mind because language would be scrambled when you attempted to speak, listen, write or read words or numbers. Like many post-traumatic life events, the original physical trauma would pass, but you could suffer a lifetime of "*social trauma" from isolation.* No matter how successful your recovery, social resiliency would depend upon others adjusting their social cognitive behavior to adapt to your impairments to simply converse. Relationships would suffer and adverse consequences of social isolation would likely to appear.

Due to the silent nature of this social alienation, the condition is hard to detect and address. Even though, there are numerous and diverse, preventative treatments of isolation are being discovered, degradation of health could be severe before health conditions are even recognized, much less measured. This is because it requires evaluating the social cognitive performance of others in the community to facilitate the social resilience of the trauma survivor re-engaging with the community.

People with Aphasia (PWA) are just one example of deployed and returning military personnel that are at high-risk for the adverse effects of social isolation. However, the Aphasia case shares common conditions and challenges of typical social isolation. Isolation can be significantly reduced for those who suffer as long as there is participation of family, friends and the community. With the Life Participation Approach for Aphasia (LPAA), the focus is on the wider community to assist in the transfer of therapy of PWAs to successfully return into the community. Solutions for LPAA can also be applied to all other populations at risk of isolation such a military personnel and their family. However, this approach relies on the participation of community centers such as libraries, museums, schools, etc. that have more access to advanced measures to provide more social engagement programs can be created, monitored and validated.

3.1   Baseline Study: StoryTrove Conversational Story Creation

Sociality is heightened when stimulated by group collaboration on a single task with an open-ended solution. StoryTroves are a box of artifacts that reveal a story when key soft skills are applied such as critical thinking, interpretative analysis, creative problem-solving and teamwork. It is designed with competing narratives that stimulate discourse that can be expressed with both verbal and non-verbal communication. This exercise was designed for PWAs to motivate spirited conversation beyond words by engaging their heads, hands and hearts.

With this in mind, StoryTroves became a successful therapeutic intervention enabling diverse community members to connect in clinics, libraries, museums and schools to practice conversational competency. We have been able reach many criteria of the LPAA framework to meet the needs of a wide spectrum of SMEs from diverse community centers. This stimulus encouraged people's natural talents to socialize and apply creative imagination for collaboration and social learning from historical inquiry. The StoryTrove activity does not

require that clinical treatment be started to be effective. StoryTroves provide cooperative tasks that participants easily adjust to the different users' level and stimulates cooperation to elevate conversational competency. The exploration of the artifacts provided a challenging, but not frustrating, unstructured social engagement. In applying experiential learning strategies that stimulated learner centered, inquiry, the activity required little mediation, instructions or rules. The activity allowed participants to freely test multiple solutions.

In working with "fictional simulation," there are no "right answers" that would discourage participation and every contribution stimulates a group response. In this way, neither PWAs or non-PWA's have an advantage with their previous knowledge. The creative process and challenges slows down the non-PWA's participation to more align with the PWA need for more time for cognitive processing. Since all participants engaged in parallel investigation, each contribution can be provided at any time. The focus on objects versus participants, reduces the stress of performance. With no scoring or time pressures encouraged cooperative game play. With extensive testing across the United States with participants from all demographics and performance levels, the activity adjusted to the level of the participants without diminishing the enjoyment of the challenge. The activity consistently lasts for 90 to 120 minutes, equivalent to watching a feature film and provided an equally fulfilling experience.

With the expert review, each SME found opportunity to screen, evaluate, diagnose and test communication skills and therapies. Since the activity exercised the imagination, challenged the creative cognition and demonstrated important social cognitive performance that were critical and valuable to measure. Since little training or preparation was needed to implement, it was an ideal baseline to test performance across to other applications for observation. This was the motivation to invent an effective and affordable means of measure to collect better evidence based data that normally could not be captured.

3.2   Subjects: Life Participation Approach for Aphasia (LPAA)

Since Aphasia was the loss of language, but not their intellect or imagination, it was a fitting case study to evaluate social cohesion and conversational competency and be a proxy to test techniques for other populations at-risk for isolation. Whether social isolation was due to disability, discrimination, deployment or displacement, the StoryTrove exercise challenged the sociality of all participants to positively overcome obstacles to socially converse and reveal their attitudes and cognitive performance. This activity was incorporated within the Life Participation Approach to Aphasia program (LPAA) used to assist public venues to be more compliant with American disability Act (AdA) concerning cognitive disabilities. It conveniently also allowed inclusion of other at-risk groups such as veterans, English as a Second Language (ESL), Social Justice mediation and racial reconciliation workshops.
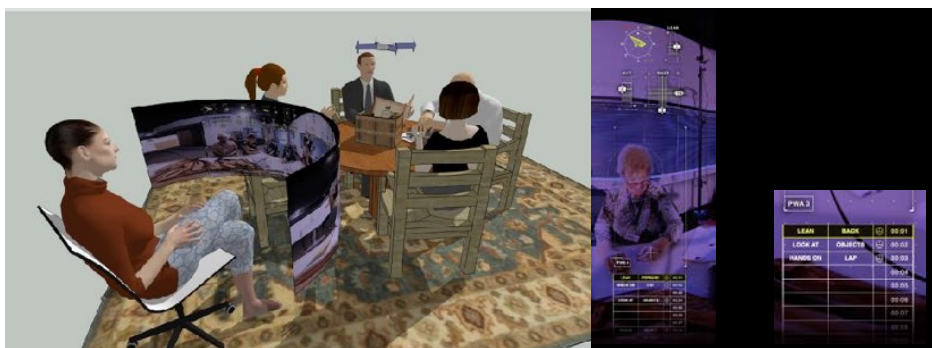

Figure 6: Remote and post analysis of StoryTrove session using immersive display (left) with data virtualization Heads Up Display (HUD)

Current Aphasia therapy has had limited success transferring communicative disorder treatment to community engagements for People With Aphasia (PWA). This prevented them to easily return to a quality of life that should be possible. In current studies within leading Aphasia treatment centers, our program was implemented as a LPAA study in three levels of participation (Physically live, digital teleconferencing and Virtual interaction).

In collaboration with leading Aphasia SMEs, we created a program that is bing implemented to capture explicit measures that could be automated audio/visual cues for evaluation. SMEs input about what they observed to facilitate and escalate enhanced sociality. With additional data, more comprehensive measures will be able to be developed to guide corrective measures when more negative behavior is observed that resulted in social exclusion, prejudice and coercion. Our intention is to lead to an on-demand program online to evaluate and improve any community's ability to provide sociality assessment, screening and training.

3.3   Stages of Sociality for People With Aphasia

With experts in the Life Participation Approach to Aphasia (LPAA) program, we have identified six observable stages of sociality that could be tagged by each SME. These observations would be subjective and easy for humans to identify, but difficult for perceptual computing to recognize. With the capture system, the human connection and social engagement would be tracked then compare individual and group performance. These data points would train the machine learning to find correlations with more explicit perceptual computing cues that could be identified automatically with machine intelligence.

Our SMEs correlated the stages with the Maslow Hierarchy of human needs and motivation to what they saw in their LPAA clients that contributed to enhanced sociality. With social connection being a basic human need and a motivation for addressing isolation, this was useful to test and less than explicit than analyzing language acquisition. Our focus was more about observant qualitative measures for overcoming communication obstacles than about acquiring explicit language as communication skills. This provided insights that can inform how to aggregate subjective/qualitative human observation with objective/quantitative perceptual computing to be able create a methodology that would an iterative evaluation that would prove better than the sum of the two parts.

Table 1: SME Tagging Subjective/Qualitative Stages of Sociality for People with Aphasia (PWA)

TAGS	Physical	Measure	Maslow
Being	Was the subject "present" and participated with signs of curiosity and active listening?	Presence	Physiological
Becoming	did they feel safe to express themselves despite reservations?	Human Connection	Safety
Belonging	did they embrace collaboration with others discoveries?	Social Engagement	Love/Belonging
Believing	did they recognize others views and unique contributions?	Opportunity for Agency	Esteem
Befriending	did they challenge their own limits for group success?	Iterative Collaboration	Self-Actualization

TAGS	Physical	Measure	Maslow
Beloved	did they create a memory or motivation that persisted beyond that session?	Persistence of Mind	Transcend

The collection and observation of these stages have been able to show how sociality exercises can contribute to building confidence in challenging subject's perceived limits and seek out help from other participants to improve communication even prior to rehabilitation. This has provided a new approach of "prehabilitation" to help prepare for more rigorous therapy. Since Aphasia is a condition that is not predictable, we will extend our investigation to apply these exercises to prepare for more predictable events of isolation as in preparing for deployment and enhancing remote communication practices.

3.3   Measuring Social Story Analogics in Conversation Construction

Our brain is hard-wired for story. When we tell a story to each other, it is like telepathy in the way the teller is able to paint with the listener's imagination and connect emotionally. With a few words, inflections and gestures, an entire world is communicated between each other without any images. Referred to as "Fictional Simulation," stories have transcended time and space to tell the story of humanity for millennium. Fictional simulation is able to create mental models that continue to grow in our minds constructed from our memories, dreams, visions and sensory perception. These new mental models from stories are then repurposed for new stories we construct to make meaning of the world and tell each other. For many, being lost in a novel can be one the most immersive experience, short of a subconscious dream. For People with Aphasia, they have sadly lost this ability of being lost in that book, because without language, written and narrated stories are just a wall of words. StoryTroves leverage artifacts to share stories beyond words and they have proven to recapture for the PWA that experience of being transported with fiction.

For the participant, StoryTroves are not a solo experience like a book, but as a social journey. The participant constructs a fuller story in collaboration with others from what the few artifacts suggest. These stories stimulated from within the imagination provide unique assistance for the PWA to create new pathways in their brain and help rediscover the language they already know, but can't access. This Conversational Story Creation is being explored to being a break-through therapy that uses sociality to bring confidence and conversation competency back to the PWA.

With the measure of sociality tracking the group story creation, we will find the ways participants can leverage narrative medicine to assist other challenges contributing to isolation such as Post Traumatic Stress disorders (PTSd), Adverse Childhood Experiences (ACE), Addiction Recovery, Restorative Justice and social reconciliation. The artifacts are authored to suggest competing narratives that stimulate multiple perspectives with conversational inquiry from other participants. Similar to the patterns of gossip, the participants spontaneous speculate about the evocative narrative evidence. Each participant takes turns being both the storyteller and story listener. The sociality of sharing stories transforms the experience into a story dance. As free-form and open-ended that the experience is, participants still follow the intended story as the author crafted.

The conversation from each participant will reveal new ways the brain can assist sociality as they take a different role, based upon their style of play. Critical thinkers and gamers see a puzzle and take on the role of a detective to solve the mystery. Interpretive analysts take on the role of historian or archeologist to construct the missing pieces of evidence. Creative problem solvers take the role of journalists constructing the human interest angle to form deeper meaning.

By having the participant learn to construct stories, they are able to gain tools to help reframe their own story and help create meaning from the transformational events in their life. Stories allows one to feel emotion without the pain and inspire creative emotion to gain hope and meaning in their lives to facilitate the recovery process.

We are describing this measurement of the impact of story on the mind as Social Story Analogies. The new measures and methodologies of sociality will help gain evidence based data to explore not medicinal healing methods to depression and isolation.

4.0 HOSPITALIZED PATIENTS: CASE STUDY FOR THE SOCIAL FIT BIT APPROACH

Due to physical and social limitations, hospitals could be approached as Extreme and Unusual Environments, or EUE. Developing a framework to support individuals in such an environment could become an opportunity to access the clinical setting as a proxy for other EUE, like military and space explorations challenges. Sharing our work with our partner company Softcare Studios, we describe a particular use case for the Social Fit Bit approach, flexible enough for further applications.

Pediatric patients undergoing hospitalization and medical procedures experience a variety of stressful and painful conditions, significantly impairing their quality of life during therapy, potentially reducing their motivation, adherence to therapy while worsening their social isolation perception. This is a process that negatively impact both the patients' therapy experience and the efficiency of therapy-related interventions. The intensity and complexity of such a process increase in more critical settings like pediatric oncology and surgery, where children experience higher levels of pain, anxiety, and social relationships disruption.

A significant part of the negative experience of pediatric patients emerges from the forced confinement in an unusual environment, highly reducing the control patients have on their life and time. Providing tools enabling alternative ways for patients to regain such a control is an intervention that can help children cope with the challenges of therapy.

Softcare Studios, developed TOMMI with a similar purpose: providing pediatric patients with a virtual reality gaming experience able to engage, motivate and distract children from the surrounding hospital environment. Through the immersion in the virtual scenery of TOMMI, the new spatial environment allows to reduce pain perception and anxiety, and also to promote a new emotional profile of young patients. Through the gamified interaction, children regain control of simple challenges and goals, building confidence and motivation. TOMMI allows to involve both children and their caregivers in collaborative gaming sessions, offering a context for therapy-unrelated communication and social connection. TOMMI becomes a new space where to build a new, positive mindset.

How TOMMI is experienced by children from the inside the VR environment, and how its gaming sessions change the social dynamics in the hospital room (among children, caregivers and doctors) could be an interesting source of data for the Social Fit Bit approach. An integrated approach to data collection and evaluation, could help clarify how TOMMI impacts the daily life in pediatric hospital, the work routine of the medical staff and the quality of relationships among patients.

On the VR side, biometric, usability and performance data could be collected to evaluate the individual condition of the young patients. Outside the VR experience, data can be collected about social interactions ongoing during (and after) the gaming sessions; how communication changes due to the immersive distraction and refocus provided by therapy-unrelated settings; how children's collaboration evolves towards medical

procedures and how that impacts the operations of the medical staff, potentially reducing time and resources involved in the care journey.

Quantifying, in a standardized and validated way, the individual well-being of children and the social interactions within the hospital community of patients could provide actionable higher level metrics related to social cohesion to monitor and improve the therapy outcomes. Once defined, the same metrics can be integrated in the planning and integration of further interventions far beyond the VR alone, and adaptable to new settings and case studies.

5.0   RESEARCH OUTCOMES: COMMUNITY BASED PROGRAMS

To date, we have been applying a consistent and engaging activity to stimulate satisfying and rewarding human connection and positive social engagement regardless of application or demographic. As we increase the range of diverse expert review we will be able to provide direction of more robust and relevant measures for social cohesion to address social isolation. As we can systemize the stimulus, capture and analysis of sociality, the process can be incorporated by industry protocol and standards being applied across sectors. With the implementation of an integrated perceptual computing program, we will be designing and conducting experiment designs within public community centers including clinics, community centers, schools, museums, entertainment destinations, etc. This effort will inform solutions that are more accessible to a wider range of SME servicing military populations.

The initial live and physical experience, is defining a baseline for sociality. The experience is being translated to online remote experiences as well as immersive virtual experiences. These adaptations are providing a framework for measuring sociality within the embedded spacial computing of SocialXR. We are expected to reveal novel approaches that address the limitations of existing social media and communication platforms. We will use the data analysis to develop alternative experiences that can leverage each future communication platform to provide alternative connections with a consistent measure of social cohesion.

5.1   Sociality in the Metaverse: Transcending Time and Space

The rapid innovation of social communication systems are moving faster than social science can keep up. As we begin to "embody the Internet" with the future Metaverse, we need to leverage the spatial computing and machine learning to provide creators the real-time assessment tools to anticipate adverse consequences of future media communication platforms. Our current investigation with the space industry is developing SocialXR experiences to provide quantified sociality tools to deep space astronauts that will address severe isolation between personal and professional networks for remote and in situ team collaboration. With humanity developing towards a transnational global network, the proposed solutions are aimed to be interoperable both for space and terrestrial applications, enabling new perspectives for sociality monitoring useful to evaluate mass-level impact, dynamics and challenges, and develop countermeasures fitting our ambitions to set the ground for a safer and healthier future.

The optimization of our system will be able to provide embedded software to augment communication hardware in locations ranging from the depths of the metaverse to the extreme conditions such as Mars colonies. Isolation. Isolation is currently the only psychological obstacle in sending humans to Mars. Without valid measures and methodology of analysis for social cohesion current plans for future space programs will not be possible. The ability to test and validate the assumptions of this investigation requires success on earth before risking humans in traveling into deep space. With missions millions of miles away with limited chance of return flights we need early tools for early self-efficacy of sociality so we can improve our own humanity,

5.0 REFERENCES

1. Extending Reality in Isolation, Stapleton, Christopher, Virtual World Society Fireside Chat with Thomas Furness III, PhD, (2020) https://www.youtube.com/watch?v=MyKbvi-2ovs&t=6s

2. Col. Chris Hadfield. (2016). "An Astronaut's Guide to Life on Earth: What Going to Space Taught Me About Ingenuity, Determination, and Being Prepared for Anything. Back Bay Books, 2014

3. Brewer, J.; Kaler, H.; Stapleton, C. B., (2011) "Unforgiving 21st Century Battlespace; Mission Competencies Mandatory" ASNE Publications, October 2011

4. Kathryn McHugh, R. (2009). Evidence-Based Practice of Cognitive-Behavioral Therapy. Cognitive behaviour therapy. 39. 1. 10.1080/16506070903190260

5. Fidopiastis, C. M. , C. B. Stapleton, J.D. Whiteside, C. E. Hughes, S.M. Fiore, G.A. Martin, J.P. , Rolland & E.M. Smith, (2005) "Human Experience Modeler: Context Driven Cognitive Retraining to Facilitate Transfer of Learning," Proceedings of IWVR 2005, Los Vegas, August, 2005

6. Space Florida Final Report (2017) Development of a Virtual World Based Communication Platform to Support Therapy Delivery