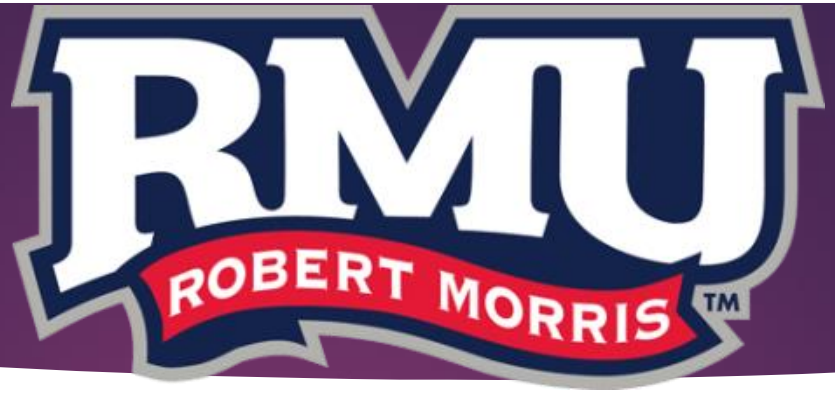


Research & Grants Expo

March 16, 2022

Session 9:00-12:00

Research Participants

Researcher	School
Andrew Ames, Ben Campbell, Tim Jones,	Arts & Humanities Engineering AMC
Celik, H. Nowicki, D. Uvet, H. Cevikparmak, S. Adana, S.	SBUS, RMU University of North Texas Georgia Gwinnet College Desales University John Carroll University
Mary Ann Rafoth Vicki Donne	SNEHS
Hongguo Wei, Diana Bilimoria, Yunxia Zhu:	RMU Case Western Reserve University University of Queensland
Gabriel Moreno	SBUS
Anthony Moretti	SIHSS

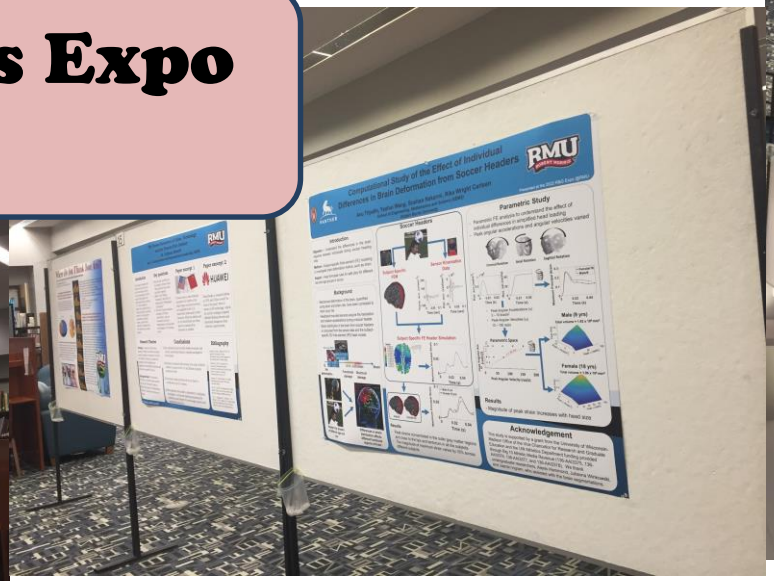
Researcher	School
Andrew Ames: Tim Jones: Emma Crites:	Arts & Humanities AMC (Student)SIHSS
Jessica L. Kamerer Betsy Guimond	SNEHS
Babara Burgess-Lefebvre, M.F.A	SIHSS
Chloe Persian Mills	University Library RMU
Kihyun Park	SBUS
Anu Tripathi, Yaohui Wang, Sushan Nakarmi, Rika Wright Carlsen:	SEMS
Monica VanDieren Isabella Deal:	SEMS
Ping Wang Hubert D'Cruze	SIHSS, RMU University of Maryland
Zhou Yang:	SIHSS

Researcher	School
Yaohui Wang, Rika Wright Carlsen:	SEMS
Peter Y. Wu, Diane A Igoche	SIHSS
Sushan Nakarmi, Yaohui Wang, Anu Tripathi, Rika Wright Carlsen [2]Alexis Hammond, [2]Julianna Winkowski, [2]Jazmin Ingram	Engineering Department, SEMS, Robert Morris University [2]Undergraduate Researchers
[1]Jeffery DeGrosky, [1]Caitlin Workmaster, [1]Nicholas Dodds, [1]Cheri McChesney, [1]Noah Minarik, [1]Brianna Proctor [1]Arif Sirinterlikci [1]Rika Carlsen, [1]Won Joo [2]Laura Leimkeuhler Mullin, [2]Peter Leimkuehler	[1]RMU, Moon Twp., PA; [2]Union Orthotics and Prosthetics Co, Pittsburgh, PA

Research & Grants Expo 2022

Research & Grants Expo Plaque Award

Research & Grants Expo 2022



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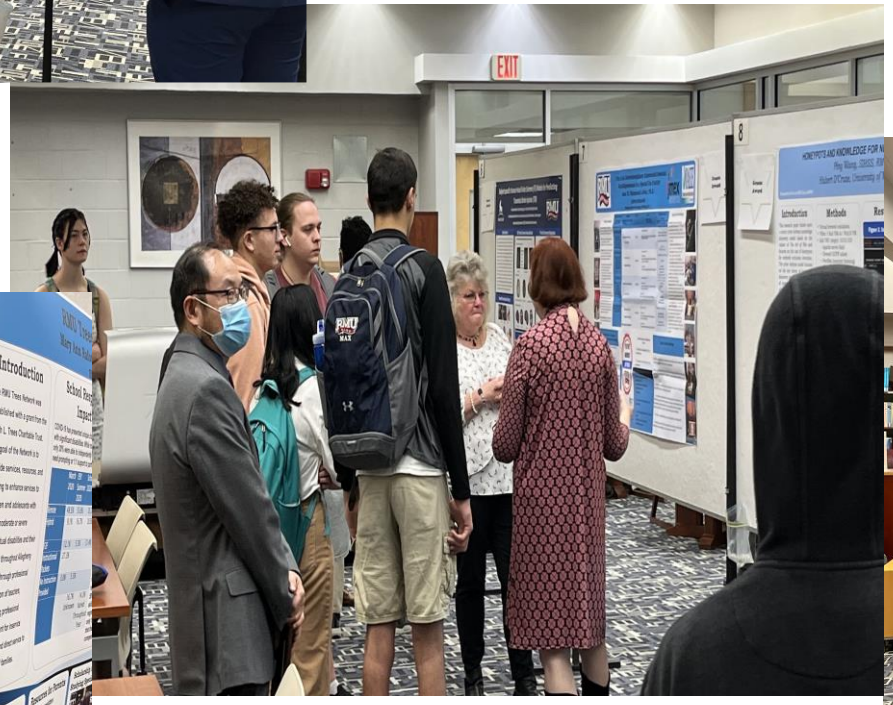

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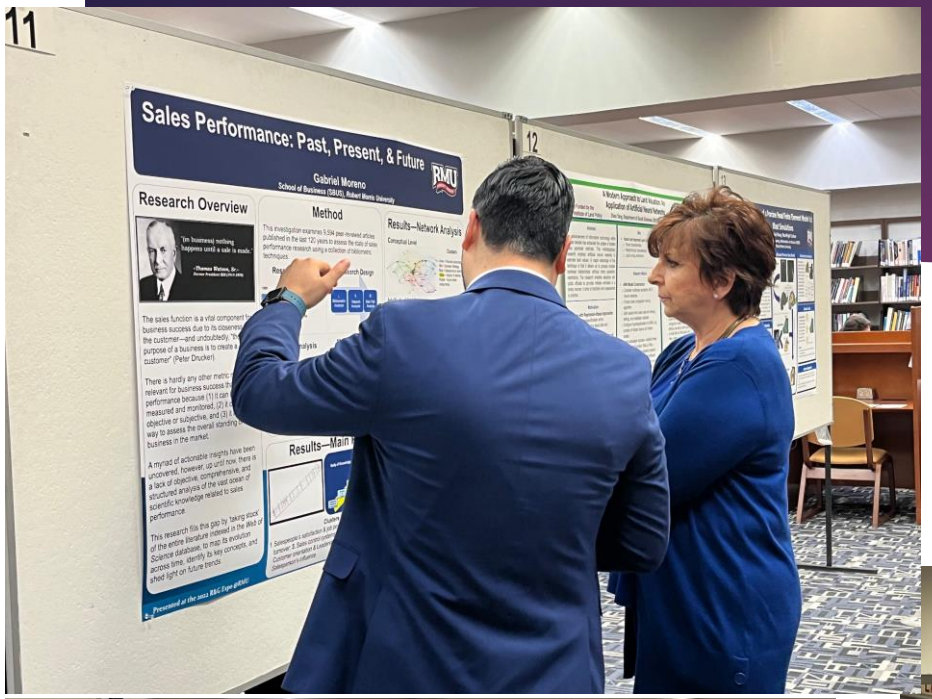
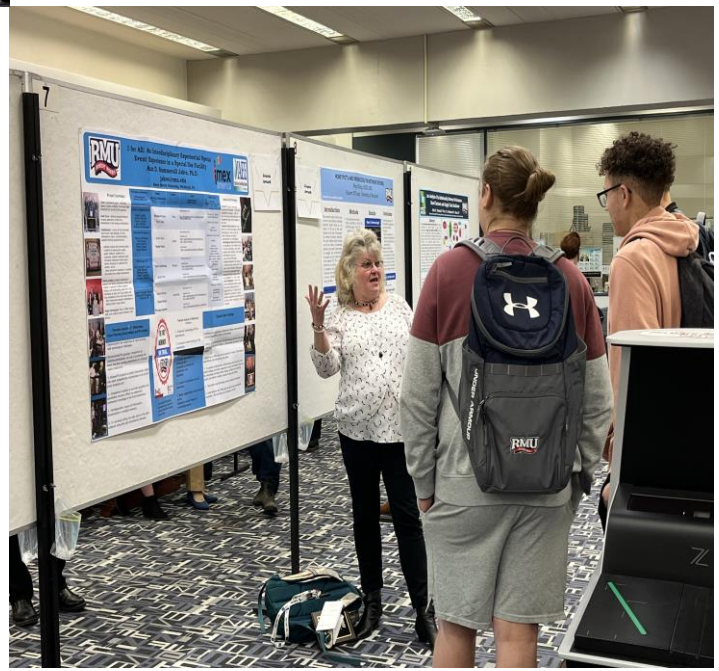




Research Posters from 5 Schools & RMU Library

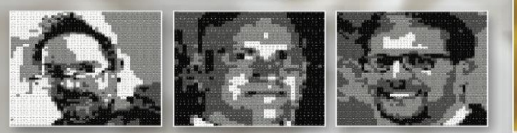
Building an Honors Seminar from LEGO

Andrew Ames, Arts & Humanities
Ben Campbell, Engineering
Tim Jones, AMC
School of Informatics, Humanities and Social Sciences
School of Engineering, Mathematics, and Science

Introduction

RMU Honors Seminar Courses are unique academic offerings that often enlist two instructors from different schools to co-teach. In Spring 2022, RMU offers for the first time HNRS3900, LEGO, a Medium of Limitless Possibilities. Designed by an engineer and two artists, the course is multidisciplinary, spanning business, art, design, animation, programming and engineering. Weekly class discussions build off assigned readings and videos documenting the LEGO Company's corporate trajectory, history of innovation (and missteps), LEGO's cultural impact, as well as stop motion animation techniques. The remaining class time is spent creating digital designs, sculpting in LEGO, generating animations, or applying principles of robotics for engineering problem solving.

We'd like to acknowledge support from CIT and the Honors Program for the classroom resources.



Building Challenges

Students are given design challenges to awaken their creativity with tasks such as building a piece of fruit, a cartoon character, a scene from a movie or a light fixture. Each challenge is limited by the 484-piece LEGO Classic Medium Creative Brick Box (set #10696). They learn to use LEGO's Bricklink studio to create a piece-by-piece 3D rendering of their design, and generate building instructions and parts lists. They have the opportunity to submit their designs to the LEGO Ideas site to be voted on by LEGO fans and if selected, made into an actual LEGO set.

2D Mosaic Designs

Students are introduced to Mosaic as an art form that has existed for thousands of years. Shown four basic visual design principles that when utilized can create visually stunning compositions. And lastly experiment with online software and Bricklink Studio to convert photos and drawings to LEGO mosaics. Students are challenged to design a compelling visual composition, generate a piece count for their idea, then assemble their creation.

Stop Motion Animations

Students are introduced to principles and techniques for LEGO animation through "the LEGO Animation book" by David Pagano and David Pickett. Students are given the opportunity to ask the authors (who have generated over $1M in revenue from creating LEGO YouTube videos) for advice and discuss creating content for YouTube during their remote lecture. They then learn to animate by capturing the deconstruction of a build, animating a minifig through a scene and making an abstract animation set to music.

Mindstorm Robot Inventor

In October 2020, LEGO launched the Mindstorm Robot Inventor set #51515 with a new coding interface based on a simple visual language, Scratch, which is able to be converted to Python for a more robust programming environment. Students will learn to build basic robots, program them, and then adapt the hardware and software to iteratively design solution to engineering challenges.

Analysis

A pre and post survey instrument was developed and received IRB approval. The survey captures the students prior experience with LEGO, artistic expression, animation, programming and engineering problem solving. It will measure their growth in these areas, and capture their reflections on the value of the learning experience.

Presented at the 2022 R&G Expo @RMU

An Analysis of the Relationship Between Performance-Based Contracts and Supply Chain Resilience

Celik, H.[a] ; Nowicki, D.[b] Uvet, H.[c] ; Cevikparmak, S.[d] ; Adana, S.[e]

[a] School of Business, RMU; [b] University of North Texas; [c] Georgia Gwinnet College; [d] Desales University; [e] John Carroll University

Abstract

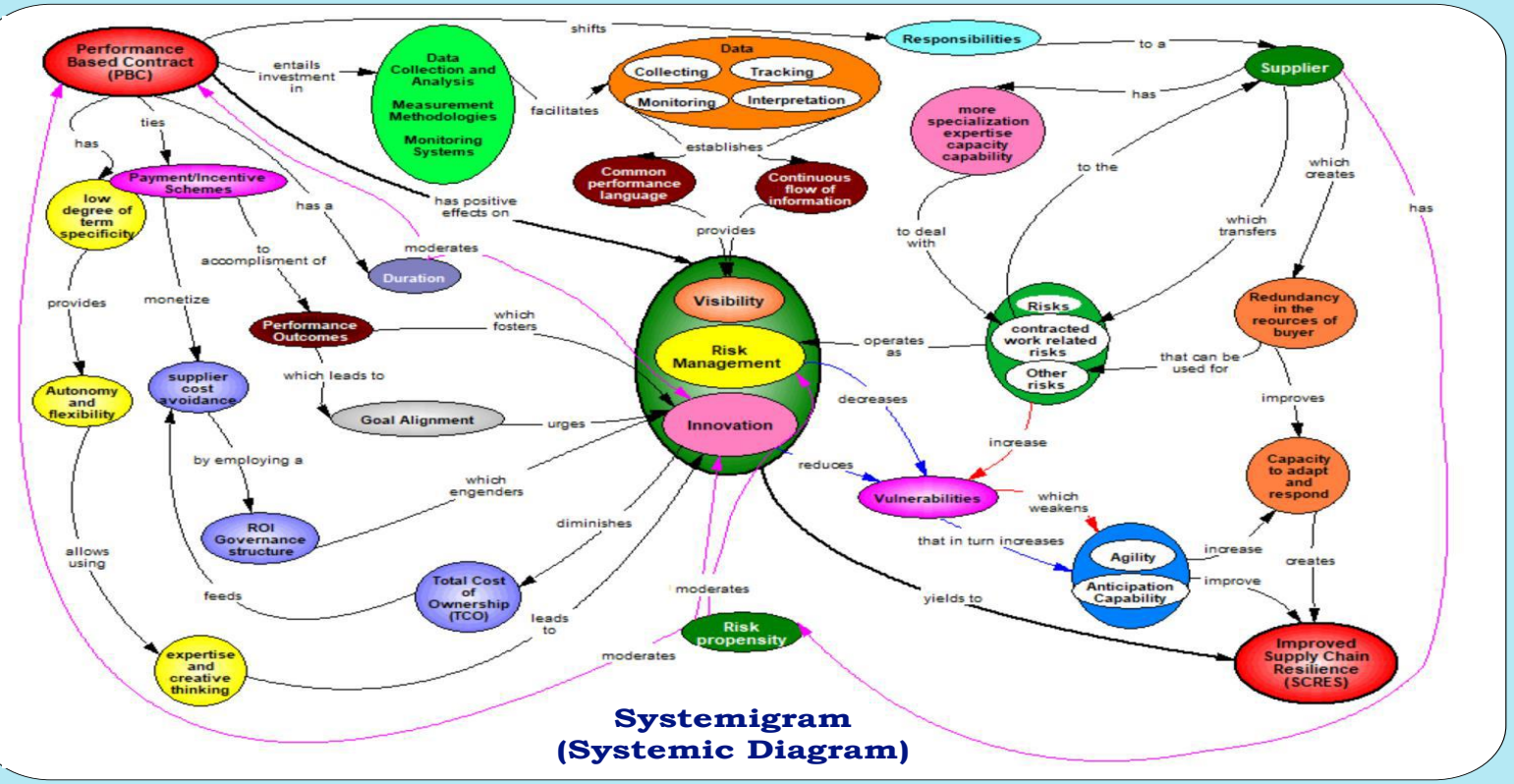
While **performance-based contracting (PBC)** has numerous implications for diverse aspects of supply chain management, **supply chain resilience (SCRES)** has become one of the top priorities of supply chain stakeholders to address the adverse effects of disruptions and make supply chains more robust, which is evident since the outburst of COVID-19. This exploratory research builds on a comprehensive literature review and develops a systemigram (systemic diagram) to delineate the key tenets of PBC and its implications on SCRES. This study proposes that, with its low term specificity, risk/responsibility transfer, and incentive schemes, PBC has positive effects on SCRES in terms of visibility, risk management, and innovation. The moderating role of the risk propensity of the suppliers and the contract length between PBC and innovation and risk management are also highlighted.

Conclusion

This study puts forth a conceptual framework with multiple propositions revealing the relationship between SCRES and PBC by bridging the existing concepts and constructs in the extant literature. It explores the relationship between these two constructs using a systemigram through the lenses of AT and RDT with a systems thinking approach and exhibits that successful implementation of PBC will have positive effects on visibility, risk management, and innovativeness of the buyer through either initiated by it or the supplier, which will, in turn, improve SCRES.

Contributions

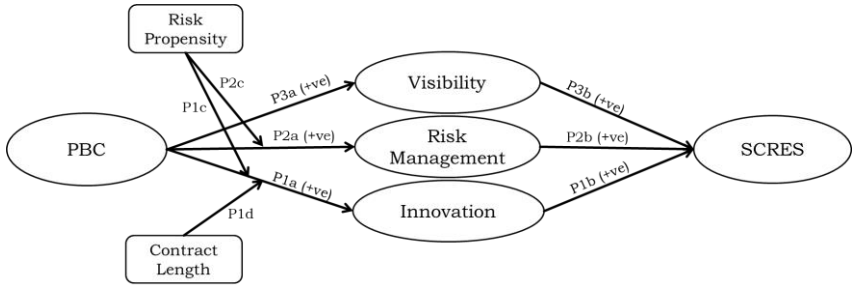
- Extends both SCRES and PBC research and underlines the importance of contracts in improvement of SCRES.
- Employs a systems thinking approach and creates a comprehensive systemigram to visually illustrate and decompose the intricate inter-relationships of PBC and SCRES.
- Provides new insight for the decision-making process of contract type selection, and urges practitioners to pay attention to the key tenets of PBC to improve SCRES.



Systemigram (Systemic Diagram)

P1a: PBC facilitates innovation.
P1b: Innovation leads to an improved SCRES.
P1c: The risk propensity of a supplier moderates the relationship between PBC and the innovation.
P1d: The contract length moderates the relationship between PBC and the innovation.
P2a: PBC has positive effects on buyer's risk management capabilities.
P2b: Risk management capabilities lead to an improved SCRES.
P2c: Risk propensity of the supplier moderates the relationship between PBC and the risk management of the buyer.
P3a: PBC leads to an improvement in SC visibility.
P3b: SC visibility yields to an improved SCRES.

Conceptual Framework



Presented at the 2022 R&G Expo @RMU

RMU Trees Network

Mary Ann Rafoth & Vicki Donne

SNEHS

Introduction

The RMU Trees Network was established with a grant from the Edith L. Trees Charitable Trust. The goal of the Network is to provide services, resources, and training to enhance services to children and adolescents with mild, moderate or severe intellectual disabilities and their families throughout Allegheny County through professional preparation of teachers, continuing professional development for inservice teachers, and direct service to children and families.

School Response to COVID & Impact on Families

COVID-19 has presented unique challenges for parents/caregivers of children with significant disabilities. While many were offered remote or hybrid services, only 20% were able to independently engage in this form of instruction; most need prompting or 1:1 support to participate.

	March 2020	ESY Summer 2020	School Year 2020–2021
Remote	48.5%	55.6%	25.7%
Hybrid	9.1%	16.7%	28.6%
F2F	12.1%	5.5%	31.4%
Instructional Packets	27.3%		
No Instruction Provided	3.0%	5.5%	
		16.7% Unknown	14.3% Varied Throughout Year

33% 1–2 hours/day
47% 3–4 hours/day
20% 5 or more hrs/day

31% reported that even though class was offered F2F, their child did not attend

While 59% of parents/ caregivers report their child regressed academically, 41% report regression behaviorally, 59% report regression in social skills, and 30% report regression in daily living skills, only 13.3% of parents reported that their child was offered compensatory services.

Community Collaborators

- A+ Schools
- Achieva
- Achieving True Self
- Allegheny County Department of Human Services, ODS
- Allegheny County Task Force on the Right to Education
- Allegheny Intermediate Unit
- Beaver Valley Intermediate Unit
- Community Options, Inc.
- Cornell School District
- DePaul School for Hearing and Speech
- Duquesne University
- Education Law Center
- Families 2 the Max
- Heart of Gold Occupational Therapy
- Laughlin Children's Center
- Montour Schools
- New Brighton Area School District
- Office of Vocational Rehabilitation
- PaTTAN (PA Training and Technical Assistance Network)
- Penn State Greater Allegheny
- Pittsburgh Learning Collaborative
- Pittsburgh Local Task Force on the Right to Education
- Pittsburgh Public Schools
- Representative Dan Miller
- St. Ambrose University
- Taylor Instructional Coaching and Consulting Services
- The Children's Institute
- The PEAL Center
- Tropical Smoothie
- University of Kansas, Department of Special Education
- Western Pennsylvania Psych Care

Professional Development

- Annual Special Education Conference
- Workshops
  - Teletherapy
  - Preparing for Transitions
  - Advocacy
  - Ableism
  - Addressing Self-Care and Burn-Out
  - How to Foster a Successful In-Person Learning Transition
- Parent Support Groups

Follow Us

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rmu.edu/academics/provost/trees

Resources for Parents

- Bi-monthly newsletters
- Database of resources
- Individual consultation meetings
- IEP Office Hours
- Assistive Technology Device Center

Scholarship for Students Studying Special Education

Presented at the 2022 R&G Expo @RMU

Reframing Materials:

Best Practices for Inclusive and Accessible Learning in an Interdisciplinary Animation Lab

Grant Agency:
The International Animated Film Society (ASIFA) Hollywood - Animation Educators Forum (AEF)

Andrew Ames, Arts & Humanities **, Tim Jones,** AMC, **Emma Crites,** Student Researcher
School of Informatics, Humanities and Social Sciences

Abstract

As media educators we must create inclusive spaces for our students to take risks and develop as creative practitioners, with equal access to resources regardless of identity, background, accessibility needs, or prior access to media. Equity in visual media and animation in particular is not just about access to educational resources but to creative and professional outcomes. Previous research initiatives have developed best practices for students and faculty in film production classrooms. However the unique attributes of animation pedagogy call for animation-specific best practices - interventions that respond to the unique inclusivity and accessibility challenges of animation labs, technologies like stop-motion and projection mapping, juxtaposition of individual and collaborative practices, and wide-ranging disciplinary applications.

In Fall 2021, an undergraduate research assistant began developing self-guided exploration materials to reduce barriers to entry in the animation labs, supporting students in applying these experiences in classes across the new Media Arts majors this Spring - from illustration and storyboarding to interactive animation and the honors Lego seminar. The team is working with faculty to apply these same tools in their own creative work, creating a student-faculty dialogue on inclusive animation practices. Finally, those collaborations will be presented in an off-campus joint animation festival screening to enhance community impact.

Self-guided Exploration Materials

Student Animation Outcomes

Presented at the 2022 R&G Expo @RMU

The Experience of Nursing Students in Developing & Delivering Multicultural Patient Education Session

Dr. Jessica L. Kamerer EdD, MSN, RNC-NIC
Dr. Betsy Guimond PhD, WHNP-BC
Robert Morris University

Presented at the 2022 R&G Expo @RMU

Background

Nurses' skills in cultural competence & humility are increasingly important because immigration, increased international travel, and diversity are common in our highly globalized world (Liu, Stone & McMaster, 2018).

- The AAN Expert Panel & the Transcultural Nursing Society defines cultural competence as, "Cultural competence refers to the knowledge (general and specific), understanding, & skills necessary to provide acceptable, safe, patient and family centered cultural care." (Giger, et al., 2007).
- Cultural humility encourages reflection, openness, & flexibility (Foronda, 2020).
- Globally, nursing educators have a responsibility to integrate cultural content in the nursing curricula (Anton-Solanas, et al., 2021) to help build the nursing skill set.
- In order to respectfully & appropriately care for diverse patient populations, RNs require intercultural communication skills (Majda, et al., 2021). Especially when providing patient teaching & education related to health & treatment.
- Research on how to develop these skills in nursing students is still evolving & best practices are being determined.

The purpose of this study is to identify themes related to the development of cultural competence and cultural humility in undergraduate nursing students after participating in mentored workshops to develop, create, & deliver antenatal patient education sessions to women in the Uganda Project.

Uganda Project

Pre-licensure students in the BSN program have the opportunity to participate in an experience to provide antenatal patient education to woman in Uganda. For this experience, they are mentored by faculty in creating patient education lessons and materials that address the healthcare, cultural and resource needs of mothers in the Kampala region of Uganda. Students then deliver the patient education lessons developed in real time via Google Meets to the women in partnership with *Mama Tulia*, a non profit agency local to Kampala. The agency streams the lesson, provides a safe gathering place for mothers to participate, and provides a translator for the non-English speaking participants.

Methods

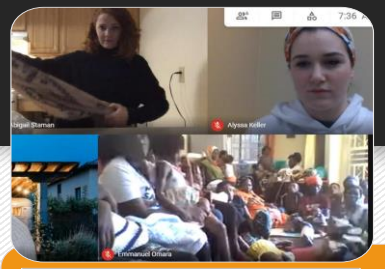
The researchers will interview student participants in the Uganda project to explore how participation in this experience has had potential influence on their nursing practice and skills.

- Semi structured interviews will be used to guide the interviews.
- This will be done in small groups or individually as participants prefer.
- A descriptive phenomenological approach will be employed to better understand the perceptions and experiences of student nurses who participated in the Uganda Project

Data Analysis

Data analysis is planned to start in Summer 2022. Researchers will:

- Observe the student participation during the development and delivery of the teaching experiences.
- In a phenomenological approach, the researchers will interview student participants in this project to explore how participation in this experience has had potential influence on their nursing practice and skills.
- Once completed, transcripts will be analyzed using the method described by Priest (2002) to explore the students' perceptions related to cultural competence and cultural humility through reading, re-reading, reflecting and comparing transcripts.
- Student evaluations will be screened for added comments related to participation in the teaching sessions. Data will be reviewed to identify recurrent themes of significant statements.



29 Total Students Participated to Date

6 Teaching Sessions Held to Date

200+ Ugandan Mothers Participated

References

Giger J, Davidhizar RE, Purnell L, Harden JT, Phillips J & Strickland O. (2007). American Academy of Nursing expert panel report: developing cultural competence to eliminate health disparities in ethnic minorities and other vulnerable populations. *Journal of Transcultural Nursing,18*(2):95–102.

Liu et al. (2018) Increasing undergraduate nursing students' cultural competence: an evaluation study. *Global Health Research and Policy, 3*(7) https://doi.org/10.1186/s41256-018-0062-2

Majda, A. et al. (2021). Evaluating the effectiveness of cultural education training: Cultural competence and cultural intelligence development among nursing students. *International Journal of Environmental Research and Public Health, 18.* https://doi.org/10.3390/ijerph18084002

Anton-Solanas, I. et al. (2021). Nursing students' experience of learning cultural competence. *PLOS One.* | https://doi.org/10.1371/journal.pone.0259802 D

Foronda, C. (2020). A theory of cultural humility. Journal of Transcultural Nursing, 31(1), 7-12.

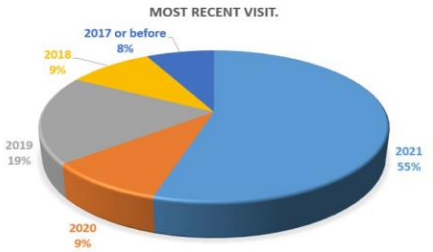
Where Do You Think You Are?

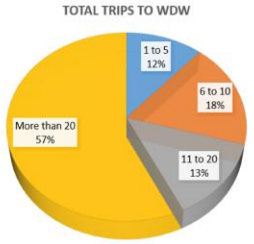
Guests' perceived immersion while experiencing Magic Kingdom attractions

by Barbara Burgess-Lefebvre, M.F.A.
Associate Professor of English and Theatre at Robert Morris University

How do guests interact with themed elements at Disney Parks? Do they engage in "pretend" play – that they are really "in" those lands and attractions?

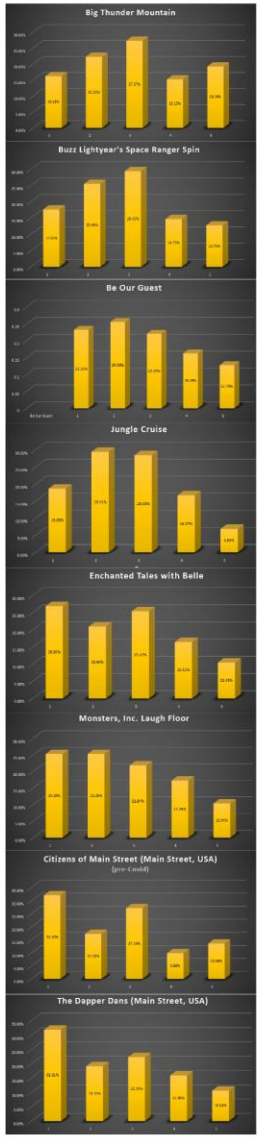
150 guests from a variety of "Disney Fan" pages were surveyed. The survey specifically targeted guests who had recently been to Walt Disney World and who were frequent visitors (who traveled there at least yearly). Respondents were from 30 states and 4 countries. 3 out of 4 respondents were women. 50% were between the ages of 40 and 60 while another 38 percent were between 24 and 40.





How immersed are guests in several Magic Kingdom attractions?

Theming and immersion is touted by Disney and its fans; how will folks who go frequently rate attractions on immersion and what elements will get the credit for that immersion? Guest experiences were rated from 1 (totally immersed in the experience) to 5 (totally outside the experience). Acknowledging that nobody is forgetting where they are – but attempting to measure the guest "buy in" to an attraction's story. Perceived Immersion: 1-5 (with the lower number indicating greater engagement).



Next step was getting some detail about which part of the attractions were adding to an immersive experience: What elements were most adding to an immersive experience? (from least immersed to most…)
Big Thunder Mountain: Queue, Ride movement, Landscaping
Buzz Lightyear's Space Ranger Spin: Ride movement, building design, music
Be Our Guest: Building design, music, cast members
Jungle Cruise: highest responses in Cast Members (including skipper) and Landscaping
Enchanted Tales with Belle: Cast members, building design
Monster's Laugh Floor: Cast members
Citizens of Main St.: Cast members
Dapper Dans: Cast members

Overall, what elements are most instrumental in creating an immersive guest experience? Cast Members, Music, and Building Design/Queue design.

And what was taking AWAY from that experience? Overall, what keeps guests from being immersed? The top answers were: Age of attraction/rides going down (10 responders), Other guests (13), and the number one answer: Cast members (21) who were distracted, not enough of them, or attraction doesn't allow for enough interaction.

The pattern became clear, and shouldn't have been a surprise. Cast members at WDW are what make it work. Their dedication to story, their positive guest interactions, and, in certain roles, their strong acting work. It wasn't the audio animatronics or awesome design, or landscaping or even the attractions themselves that were the number one factor in determining whether a guest felt immersed in the experience.
It was the Cast Members. And too, cast members were responsible when the "magic" failed; when they are talking with each other or not paying attention to guests, when they do the minimum of loading guests into cars instead of telling the story. Disney needs to invest in their team. They need to bring back many equity (actors union) who are still at home following 2020 closures.
They need to recognize that no matter how wonderful an attraction is – that ultimately it is the cast member that can make or break the immersion for a guest.

Presented at the 2022 R&G @ Expo

Can Unionization Prevent Toxic Workplaces?

Chloe Persian Mills

University Library, Robert Morris University

Introduction

This project was written in response to the a call for research on toxic workplaces in higher educational environments to be published by the premier librarian association in the United States, Association of College and Research Libraries. The qualitative data and subsequent thematic analysis provides a rich understanding of the types of cultural fissures that may emerge in and around faculty unions and also the significant ways in which collective bargaining and union contracts may help to manage workplace conflict.

Methodology

Qualitive Methods:

22 Questionnaires;
1 Recorded Interview

- Attributive coding
- Secondary coding
- Thematic analysis

Visual Representation: A definition of *toxic workplace*

Respondent Characteristics

Career length	Early career – approximately 5 years or less	Mid-career – 6 – 15 years in the profession	Late Career or Retired – 15 or more years in the profession	
	1	9	12	
Type(s) of Positions	Faculty or Staff Librarian only	Both Faculty and Administrative positions in one or more libraries	Administrative position only	
	12	9	1	
Union Membership or Activity	Not Indicated	Never a Union Member	Some Time as a Dues-paying Member	Activity in Union beyond Mere Membership
	1	4	6	12
Relationship to Author	Known to Me and Identifiable from Answers	Not Known and Not Identifiable from Answers	Known to Me but NOT Identifiable from Answers	
	7	14	1	

Themes:

1) Unions lesson toxicity through restraint of management.
2) Unions cannot entirely fix the conditions of the workplace, AKA, "Oh! The humanity!"
3) Collective bargaining mitigates against conflict and many aspects of toxic workplaces by ensuring pay for work done, procedures and processes, security, and consistency for members and administration alike.

Conclusions

- Toxic leadership is necessary and sufficient for the creation of toxic workplaces.
- Unionization and collective bargaining cannot prevent all negative workplace cultures.
- The primary source of conflict that can arise around unionization can be seen as part of fundamental divides between groups that are in the university regardless of the presence of unions and pre-existing human tendencies to tribalism; such groups include: 1) staff, faculty (librarians), and administration; 2) library faculty and teaching faculty; 3) part-time employees and full-time employees; 4) early career employees and mid to late career employees.

Additional Reading

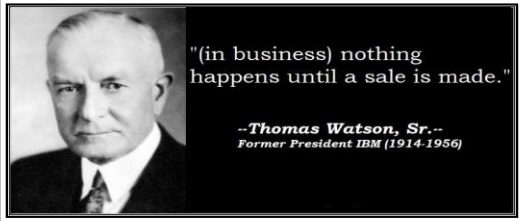
Chloe Persian Mills and Ian McCullough. "Academic Librarians and Labor Unions: Attitudes and Experiences," *portal: Libraries and the Academy,* 2018, no. 4: 805-829.

Presented at the 2022 R&G Expo @RMU

Sales Performance: Past, Present, & Future

Gabriel Moreno
School of Business (SBUS), Robert Morris University

Research Overview



The sales function is a vital component for business success due to its closeness to the customer—and undoubtedly, "the purpose of a business is to create a customer" (Peter Drucker).

There is hardly any other metric more relevant for business success than sales performance because (1) it can be easily measured and monitored, (2) it can be objective or subjective, and (3) it is a simple way to assess the overall standing of a business in the market.

A myriad of actionable insights have been uncovered, however, up until now, there is a lack of objective, comprehensive, and structured analysis of the vast ocean of scientific knowledge related to sales performance.

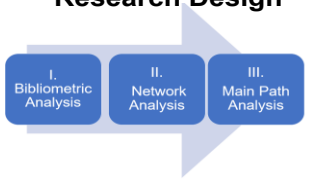
This research fills this gap by 'taking stock' of the entire literature indexed in the *Web of Science* database, to map its evolution across time, identify its key concepts, and shed light on future trends.

Method

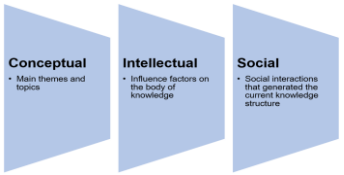
This investigation examines 9,594 peer-reviewed articles published in the last 120 years to assess the state of sales performance research using a collection of bibliometric techniques.

Research Scope

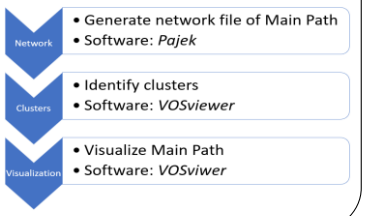
Research Design



Network Analysis

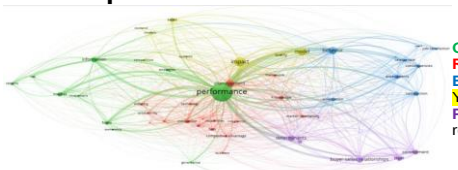


Main Path Analysis



Results—Network Analysis

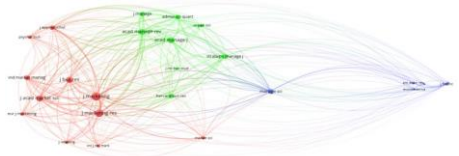
Conceptual Level



Clusters

Green = financial outcomes,
Red = Business Strategy,
Blue = Salesperson's activities,
Yellow = Industry & Market,
Purple = Buyer-seller relationships

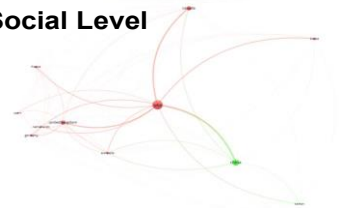
Intellectual Level



Clusters

Green = Management
Red = Marketing
Blue = Finance

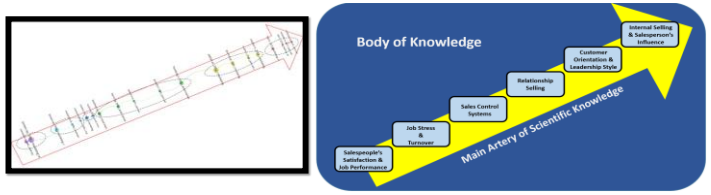
Social Level



Clusters

Red = Western
Green = Non-western

Results—Main Path



Clusters

1. Salespeople's satisfaction & job performance; **2.** Job stress & turnover; **3.** Sales control systems; **4.** Relationship selling; **5.** Customer orientation & Leadership style; **6.** Internal selling & Salesperson's influence

Conclusions

1. The sales function is shifting from a tactical/operational imperative to a strategic one.
2. Sales knowledge has been almost exclusively been studied from the *Western* paradigm.
3. Sales knowledge is increasingly being studied by other business disciplines.
4. The main path reveals that sales are evolving from a predominantly *inter-organizational* focus to an intra-organizational one.

Presented at the 2022 R&G Expo @RMU

The Flawed Narratives of China, Technology and the Twenty-First Century

Dr. Anthony Moretti

Dept. of Communication and Organizational Leadership, SIHSS

Introduction

This research examines the friction between China and the United States, and the role technology gurus, think tanks, policy makers and other experts play in framing U.S.-China relations. It makes the argument that the American public is not being served by the incomplete assessment of China's history, potential and ambitions it receives from elite media and so-called experts.

Key questions

1. What factors contribute to the negative rhetoric about China used by think tank and other experts?
2. What is the "Beijing Consensus" and why is it replacing the "Washington Consensus?"
3. How will Chinese scholars – working at Chinese universities – play an increased role in the examination of AI and other technologies in the coming years?

Paper excerpt 1

China's actions, often instantly assumed to be hostile to the Asian region or across the world, are magnified by the U.S. mainstream media and in elites' discourse, while any similar acts by the United States are either ignored or passed off as necessary or justified.

Paper excerpt 2

HUAWEI

David Sacks, a research fellow at CFR, said China is well "in front of the pack" when it comes to 5G technology, which he and his colleagues argued afforded Beijing intricate and potentially dangerous data collection opportunities.

Research Theories

Framing: "a process in which some aspects of reality are selected, and given greater emphasis or importance, so that the problem is defined, its causes are diagnosed, moral judgments are suggested and appropriate solutions and actions are proposed" (Entman)

Propaganda Model: The economic Structure of corporate media ensures that any anti-democratic ideas or elements are ignored or dismissed as beyond the mainstream (Herman and Chomsky)

Conclusions

- ❑ The multifaceted and intricately wedded economic and cultural partnership remains a complex paradigm for both societies
- ❑ Economic uncertainty will continue to be a fact of life for millions of people in the U.S. and billions of people around the world
- ❑ Convenient media narratives of "us vs them" is insufficient in the 21st century
- ❑ News agencies must make a commitment to legitimate investigative and factual reporting examining how Americans must prepare for technological growth and professional insecurity

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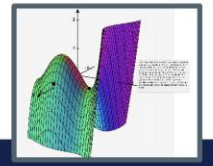
Presented at the 2022 R&G Expo @RMU

An Open Source Collection of Multivariable Calculus Problems

Principal Investigator: Monica VanDieren (Robert Morris University, School of Engineering, Mathematics, & Science)
Contributor: Isabella Deal (Robert Morris University, School of Engineering, Mathematics, & Science)

PA Grants for Open and Affordable Learning (PA GOAL)

- Accessible & Equitable Open Educational Resources (OER)
- Multivariable Calculus Content with New Applications
- Interactive, Randomized, and Graphical Problems



Accessible & Interactive

Students have access on Day 1 to OER regardless of financial barriers. The nature of multivariable calculus presents challenges for online hw:

- Dynamic 3D graphs for better visualization
- Alt-Text conventions are limited for 3D figures
- Allowing students to enter in a graph as their response to a prompt

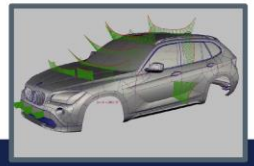
Solar Energy

The existing bank of multivariable calculus problems in WeBWorK are limited in both the scope of "real world" applications and their pedagogical approach (e.g., content, representation, and cognitive complexity) (Moore-Russo & VanDieren, 2022).
Solar energy application problems not only address these gaps but also **connect students to the content** by using data relevant to their location.

Machine Learning

Most existing calculus books include only applications to classical 100+ year-old problems. This project leverages students' interest in modern technology by composing several exercises that apply multivariable calculus concepts to **computer graphics:**

- Snapchat Filters
- Animation (ray-tracing)
- Image detection
- Image recognition
- Convolution



Structural Engineering

While structural engineering relies heavily on physics concepts rooted in multivariable calculus, the geometric concepts that are applied to structural engineering are not often emphasized. This project sheds light on **geometric applications:**

- 3D-Printing
- CAD design
- Curvature Combs
- Area Moment of Inertia of I-Beams

Share icon is downloaded from nounproject.com and was created by Iconstock. Image of car with curvature combs is downloaded from themodeldesign.net/how-cas-helps-products-stand-out-computer-aided-styling. The solar map image was obtained from Sengupta, M., Y. Xie, A. Lopez, A. Habte, G. Maclaurin, and J. Shelby. (2018). "The National Solar Radiation Data Base (NSRDB)." Renewable and Sustainable Energy Reviews_89 (June): 51-60.

CalcPlot3D

WeBWorK

RMU ROBERT MORRIS

Poster presented at the RMU R&G Expo

HONEYPOTS AND KNOWLEDGE FOR NETWORK DEFENSE

Ping Wang, SIHSS, RMU
Hubert D'Cruze, University of Maryland

Presented at the 2022 R&G Expo @RMU

Introduction

This research paper draws upon a recent cyber defense knowledge discovery model based on the classic of *The Art of War* and focuses on the use of honeypots for network intrusion detection. The cyber defense model focuses on the key factor of knowledge discovery (and lack of knowledge) of strengths and vulnerabilities of yourself and your opponent in cyber defense (CD). The model is tested with a network simulation of honeypots and detections of intrusions and distributed denial of service (DDoS) attacks on a virtual network.

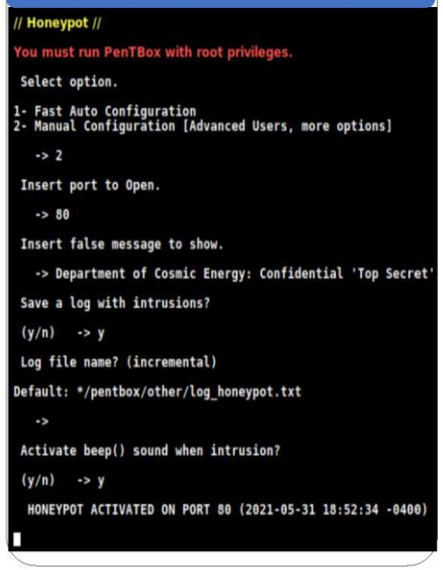
Table 1. CD K & Goals Model

Knowledge	Goals
Know your Vs; Know how to mitigate Vs; Know how to hide your Vs; Know how to set up fake Vs. ***V***=*Vulnerability*	Minimize your Vs; Assess & manage your Vs and risks; Minimize enemy's K of your Vs; Mislead/deceive your opponent. ***K***=*Knowledge*
Know enemy's strengths Know enemy's assets and Vs Know how to discover your opponent's Vs.	Avoid strong spots of your opponent; Exploit the Vs of your opponent; Maximize your K of your opponent.

Methods

- Virtual network simulation
- VBox: 2 Kali VMs & 1 Win10 VM
- Kali VM1 (target): 10.0.0.102
  - Apache server (bait)
  - Firewall GUFW (allow)
  - PentBox honeypot (listening)
  - Wireshark for traffic captures
- Kali VM2 (test): 10.0.0.101
  - Test web server
  - Lure intruders
- Win10 VM (attacker): 10.0.0.103
  - Launch intrusions & DDoS
  - Tool: LOIC (Low Orbit Canon)
  - MITRE CVE DDoS data

Figure 1. PentBox Honeypot



Results

Figure 2. Intrusions Logged

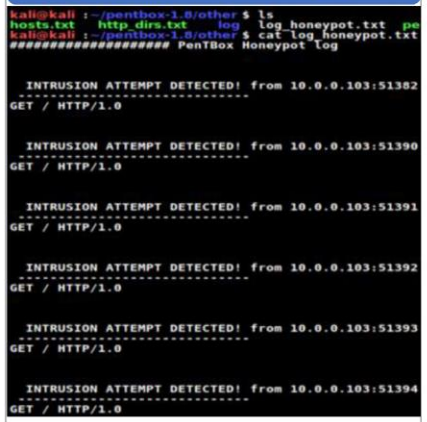
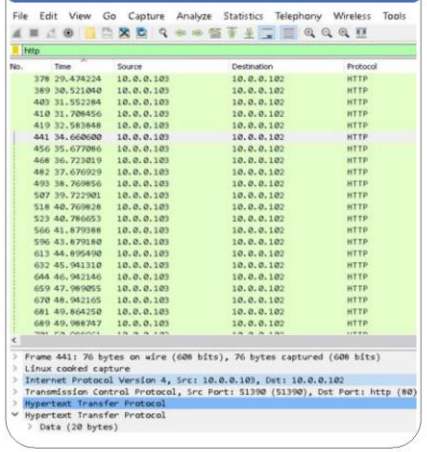


Figure 3. DDoS Flooding Captured

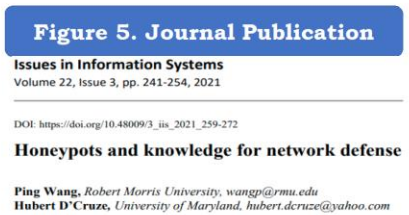


Conclusions

- K (Knowledge) discovery of V (Vulnerabilities) is significant to cyber/network defense.
- K Dynamics:
  - Discover/increase your K
  - Mislead/deceive opponents to increase their ignorance and decrease their K.
- Honeypot: Effective and attractive tool for deception, intrusion detection, K discovery
- LOIC: DDoS simulation tool for network intrusion and flooding
- Higher Goal of CD and network Defense: Strategies/innovations

Figure 4. Best Paper Award

Figure 5. Journal Publication



Adopting Additive Manufacturing Technologies for Orthotics and Prosthetics

Jeffery DeGrosky[1], Caitlin Workmaster[1], Nicholas Dodds[1], Cheri McChesney[1], Noah Minarik[1], Brianna Proctor[1], Laura Leimkeuhler Mullin[2], Peter Leimkuehler[2], Arif Sirinterlikci[1], Rika Carlsen[1], Won Joo[1]
[1]Robert Morris University, Moon Twp., PA; [2]Union Orthotics and Prosthetics Co., Pittsburgh, PA

Introduction

Our project, "Adopting Additive Manufacturing Technologies for Orthotics and Prosthetics," is a collaborative effort with Union Orthotics and Prosthetics to integrate additive manufacturing technologies into traditional manufacturing for custom prosthetics needs. Our work explores the use of additive manufacturing for patient-specific medical devices in the prosthetics industry. Our goals are to reduce manufacturing time and cost of traditional manufacturing efforts, improve patient satisfaction, and minimize outsourcing of prosthetic components. Our work focuses on design optimization as well as developing streamlined additive manufacturing processes for prosthetic sockets, and prosthetic replacement parts. Past studies focused on measuring the mechanical properties of our 3D printed check prosthetic sockets through mechanical testing to determine if they are suitable for clinical use. Current studies focus on finite element analysis of prosthetic sockets to develop a new shape optimized model. Future studies will focus on further mechanical testing, comparing a control socket and a new shape optimized prosthetic socket using the same testing parameters. This research will lead to more efficient and effective manufacturing processes that can be applied more broadly to the medical additive manufacturing industry.

Mechanical Testing in the Horizontal and Vertical Directions from Past Studies

Methods

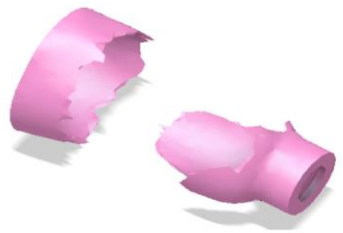
Using Fusion 360 we conducted Static Stress and Shape Optimization simulation studies on a transtibial prosthetic socket.

Design, manufacturing, verification, and validation of 3D printed prosthetic sockets is being performed, including:

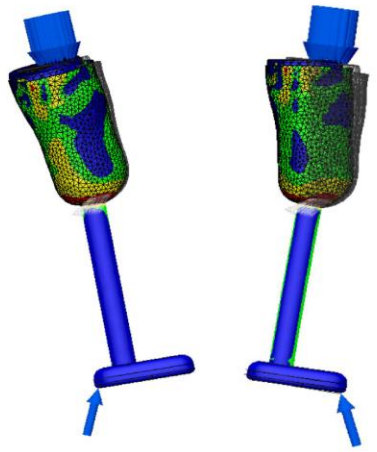
- Optimization of **socket shape, materials, and 3DP parameters**
- Finite Element Analysis to match the physical tests

Using information found in the paper, *Analysis of transtibial prosthetic socket materials using finite element method* written by Prasanna Kumar Lenka and Amit Roy Choudhury, and mechanical testing conditions based on ISO 10328:2016(E) and ISO 22523:2006 used in our past studies, we simulated the socket under the following loading conditions:

- Assigning material properties for both the socket, lower prosthetic leg, and the rim
- Defining the contacts between bodies as sliding frictions
- Assuming the knee remained in place during simulation
- Assigning the angle of the applied load



Preserved Regions of Socket from Shape Optimization



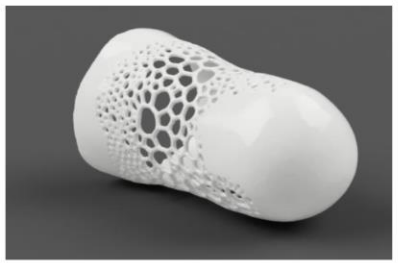
FEA Simulation of the Gait Cycle

Results

- After conducting static stress studies using FEA on sockets in both the horizontal and vertical directions we were able to compare both the software results and the mechanical testing results to proceed onto shape optimization studies.
- Through FEA analysis of the gait cycle on a prosthetic socket we found that only the top and bottom sections of the socket are necessary for structural stability.

Conclusions

- Only necessary material was kept within the socket preserved regions.
- The proximal end of the socket is bridged with the optimal socket shape using a voronoi pattern to fill in any gaps between the preserved regions.
- The new socket will be tested using both FEA software and mechanical testingl to verify that it meets both ISO 10328:2016(E) and ISO 22523:2006 standards.
- It will also be tested alongside a control socket to ensure that the results are comparable when analyzing the strain.
- Using the results from these tests, we will be able to cut down on the manufacturing and 3D printing times for prosthetic sockets to develop more efficient and effective processes.



New 3D Printed Socket Created from the Preserved Regions and a Voronoi Pattern Mesh to Fill in the Gap between Preserved Regions

Presented at the 2022 R&G Expo @RMU

GIS for Democracy: toward a solution Against Gerrymandering

Peter Y. Wu, Diane A Igoche
Dept of Computer & Information Systems, SIHSS, Robert Morris University

Introduction

Political redistricting is conducted by the state government. The party in power can manipulate that for political advantage – known as gerrymandering since 1812. The past two decades have seen many cases of extreme gerrymandering: politicians refine redistricting to choose voters.

- GIS is the culprit.
- Legally difficult to prevent.
- We want GIS to be the solution.
- Here is our proposal.

Brief History

1812 – Redistricting done manually.

Elbridge Gerry **(1744-1814)** as Massachusetts governor created a voting district in the shape of a salamander and the state legislature accepted.

1907 – known as Gerrymandering.

… not a problem until …

1990… GIS with data available.

The past 20 years, we began to see cases of extreme gerrymandering – politicians create districts to choose their favorite voters to secure their own positions.

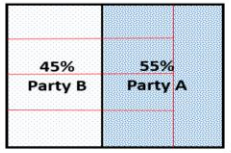
Strategy Basic

How to do gerrymandering?
Two fundamental approaches:
Cracking and Packing.

Simple Example: Party A majority. Party B minority.

Cracking: Party A suppresses the minority.

Packing: Party B packs majority to few districts to crack the rest.

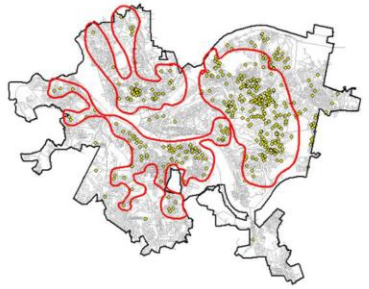


Using GIS…

- Collect individual data about party affiliation, or voting inclination.
- Geocoding: visualize on a map
- Map digitizing – visually create new district boundaries.
- Spatial Join: evaluating the voting inclination of the district.
- Trial and Test – until a map with districts desirable for political gain.
- GIS and the availability of data become the culprit of extreme gerrymandering.

Gerrymandering:

just draw and re-draw till it fits…



Can we prevent it?

- Non-partisan redistricting
  by an independent commission:
  Who should be on the commission?
- Total popular vote
  Abolish the winner-take-all rule:
  Districts will not matter.
- Identified by computer algorithms
  "Impossibility Theorem for Gerrymandering" (Alexeev & Mixon 2018)
- Automation of re-districting
  - (Ingraham 2014) – Olsen to use census block boundaries. (not acceptable)

Pennsylvania redistricting by Olsen algorithm, using census block boundaries.

  - Levin & Friedler (2019) using a recursive triangulation algorithm – criteria based on demographics data. (can there be bias?)

Toward a Solution

- Require public scrutiny
  The party in power has the right to redistricting must disclose their reasons – face public scrutiny.
- Allow alternative proposal
  opposing parties (or the public) may propose alternative redistricting plan to face the same scrutiny.
- Redistricting by vote
  removing the redistricting authority from the governing party: proposed plans of redistricting should be voted.

Conclusion

Let us promote GIS education, for the sake of democracy.

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Wu & Igoche, "GIS for Democracy: toward a solution against Gerrymandering", paper presented at CONISAR 2021, Washington, DC

Presented at the 2022 R&G Expo @RMU

A Modern Approach to Land Valuation: An Application of Artificial Neural Networks

Research Funded by the Lincoln Institute of Land Policy

Zhou Yang, Department of Social Sciences, SIHSS

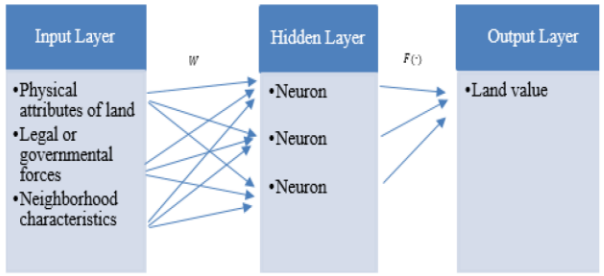
Abstract

The advancement of information technology within the last decade has enhanced the uptake of modern mass appraisal methods. This interdisciplinary research employs artificial neural networks to estimate land values. A major advantage of this technique is that it allows us to process complex nonlinear relationships without many parametric restrictions. The research enables assessors and public officials to provide reliable estimates in a timely manner. It aims to facilitate land assessments in practice.

Motivation

- **Issues with Regression-Based Approaches**
  - Serious misspecification errors
  - Strong assumptions about data and functional forms
- **Comparative Advantages of Artificial Neural Networks (ANNs)**
  - No or much less parametric restrictions
  - Better performance in more volatile pricing environments compared to hedonic pricing models.

Figure 1: ANN Architecture Example (Real Estate Studies)



Data

- **Vacant and Improved Land Sales Data**
  - Parcel characteristics
  - Neighborhood characteristics
  - Local zoning restrictions

Research Method

- **ANN Model Construction**
  - Consider multilayer perceptron (MLP) neural networks
  - Employ back propagation training algorithm
  - Split vacant land sales data into training, testing, and validation datasets
  - Configure hyperparameters for ANNs (e.g. number of hidden layers and hidden nodes)
  - Select activation function—rectified linear unit activation function (ReLu): ReLu rectifies the vanishing gradient problem; the function form is simple and efficient; however, Relu could result in dead neurons and Leaky Relu is introduced to keep the updates alive.
- **Estimate Land Values Using ANN Models**
  - Out-of-sample predictions using improved sales data
  - Examination of predictions for parcels in economic units

Results

- **Optimal Configuration**
  - An MLP neural network with two hidden layers works the best for the obtained land sales data.
  - The number of hidden nodes should be determined through a robust test harness with controlled experiments.
  - Training iteration parameter can influence the ANN construction. One should iterate until the error does not significantly decrease.

Conclusion

- Experimentation with ANN model configuration needs to consider efficiency as well as model capacity.
- A model with too little capacity won't help us learn much about land sales activities, whereas a model with too much capacity would overfit the training dataset. Both cases would lead to a model that does not generalize well.
- The method can be extended to estimate the market value of any given land site.
- ANN models can reduce estimation errors and perform better compared to hedonic pricing models.

Presented at the 2022 R&G Expo @RMU