MDes by Research Topics

(for academic year 2024-2025 intake)

IDC School of Design, IIT Bombay offers an MDes by Research programme. The areas of research in IDC evolve continuously in response to new challenges emerging in the world of design. For the intake of the academic year 2024-2025, IDC is seeking candidates who are interested in pursuing design research in any one of the following topics:

1. Exploring applications of game and game design principles in non-game contexts
2. Investigating game structures, player interactions, and player experiences
3. Updating the user-usage model of technology adoption by emergent users
4. Supporting health and fitness with the aid of technology
5. Text input in Indian languages
6. Design Hybridization: An approach to design products / furniture / future devices with new narratives
7. Understanding the grammar of storytelling in virtual reality narratives
8. Novel interaction techniques for augmented / virtual reality
9. Exploration of the language of virtual reality storytelling
10. Tangible user interface designs for older adults
11. Wearable devices for tactile interaction
12. Adaptive patient transfer system for individuals with limited lower body mobility

This document contains a description of each topic, a short review of the prior work, related papers and suggested reading material, a brief for the research proposal, expected background of the applicant, and sample questions. In case you need any help in accessing the referred papers or additional reading material, please send an email to idcrefs@idc.iitb.ac.in. To this email id, please send ONLY queries related to the suggested reading material.

A candidate should choose any ONE of these topics and read the suggested material. At the time of **application**, the candidate is asked to submit a 500-word research proposal for their chosen topic. The proposal should clearly identify the research question that the candidate wants to investigate and describe a research method that can be used to answer the same. We encourage candidates to read the material suggested for their chosen topic before writing their research proposal.

Candidates are shortlisted based on their CEED scores. Shortlisted candidates will be called to appear for a **written test** and an **interview** in IDC School of Design. If shortlisted, the candidate should come prepared with the material suggested for the chosen topic. The written test and the interview will assess the candidate's design abilities, research aptitude, and the knowledge in the chosen topic. For more details on the admissions process, please refer to the Admission Brochure.

Topic 1

Exploring Applications of Game and Game Design Principles in Non-Game Contexts

Description of the area

In recent years, there has been a shift towards incorporating gaming mechanisms in non-gaming areas, such as education, health, fitness, mobile applications, as well as various services and systems. This research category considers games as a tool for improving user engagement and transforming user behaviour. Incorporating game-like mechanisms with the non-gaming context poses design challenges as articulated by Athavale and Dalvi (2018). Research projects under this umbrella can include – but may not be limited to – processes of designing games in non-game contexts, understanding the technical and practical challenges encountered when applying games to diverse settings, artefact analysis, the impact on user experiences, and the evaluation of games as an intervention.

Short review of prior work

Our group developed 'EndoGen Framework' (Athavale and Dalvi, 2021) which facilitates game designers to develop endogenous games. This framework was inductively developed by studying design processes of educational game designers. The framework shows promise in the direction of integrating game elements with the content. To gain a grasp of the subject, please refer to our research group's papers related to this area and additional references given below. As an additional supplement, undertaking a course on game design would greatly assist in understanding how games are designed, particularly the recommended course available at the following link: https://onlinecourses.swayam2.ac.in/aic20_ed01/preview

Brief for a research proposal

Work in this area can broadly be directed in three possible directions. First, while the EndoGen framework was developed specifically for educational content, it would be interesting to see whether the suitability of the framework with other content and contexts like health, finance, etc. Keeping the semantic mapping of content with the mechanics, candidates should propose topics that affords reflection on the nature of different contents, as well as the mechanics. There are potentially several MDes by Research topics that the candidate can propose. Here is a short list of possibilities:

1. Applying game design principles in early and middle school subjects/activities in the Indian context
2. Health and Rehabilitation through game design in India (ExerGames)
3. Game design for adult learning and training
4. Play as a means for environmental education and awareness etc.

Expected background of the applicant

Candidates should have completed a basic review of literature; they must have read and analysed group papers and literature marked as ***. Those marked as ** and * are supplementary materials. Furthermore, they should have an understanding of a wide variety of game genres, should have played at least 10 different board games excluding commonly played ones like Chess, Carrom, and Ludo.

Sample questions

- Briefly explain the differences and correlations between endogenous and exogenous gameplay? Please provide examples from games you've played. • Describe an experience where you've observed the principles of game design applied in a non-gaming context. How successful was the application, and why?

References

1. *** [Paper] Strategies for Endogenous Design of Educational Games. Athavale and Dalvi. Link
2. *** [Paper] Discovering Strategies for Design of Purposeful Games—A Preliminary Study. Athavale and Dalvi. Link
3. *** [Paper] A method to study purposeful game design process. Athavale and Dalvi. Link
4. *** [Paper] Endogen: Framework for Designing Endogenous Educational Games. Athavale and Dalvi. Link
5. ** [Paper] The Lens of Intrinsic Skill Atoms: A Method for Gameful Design by Sebastian Deterding. Link
6. ** [Paper] The LM-GM framework for Serious Games Analysis by Lim, Arnab, and colleagues. Link
7. ** [Paper] Does gamification work?—A literature review of empirical studies on gamification by Juho Hamari. Link
8. ** [Paper] Defining gamification - A service marketing perspective by Juho Hamari. Link
9. ** [Paper] Shallow Gamification - Testing Psychological Effects of Framing an Activity as a Game by Andreas Lieberoth. Link
10. * [Book] Game Design Workshop: A Playcentric Approach to Creating Innovative Games by Tracy Fullerton
11. * [Book] Resonant Games by by Eric Klopfer, Jason Haas, Scot Osterweil and Louisa Rosenheck
12. * [Book] Situational Game by Brian Upton

Topic 2

Investigating Game Structures, Player Interactions, and Player Experiences

Description of the area

This research area focuses into the player's meaning-creation processes in games. Viewing games as a ludological system (refer Eskelinen, 2001 and Rules of Play, 2004), which argues broadly that games create experiences in different ways than movies, stories, paintings, etc. Players follow rules of the game and create experiences from the same. Researchers in this area analyse games, player interactions, and player experiences such as fun, immersion, engagement, and so forth (Dhamelia and Dalvi, 2020) which include aspects of game design and interaction such as gameplay aesthetics (Lundgren, 2009) and formal gameplay analysis.

Projects in this area can encapsulate designer's design processes and player's sense-making in games. It can also involve game structure analysis in relation to the emanated experiences (Dhamelia and Dalvi, 2022), genre problematization and formation, playtesting, game balancing, and game formalism.

Short review of the prior work

Our earlier work has articulated challenges of second-order design problems, which is a central issue in the domain of game design (Dhamelia and Dalvi, 2023). It posits that designers cannot design the experiences directly and the experience emerges only through game structure. The distance between the designer and her creation (gameplay experiences) – called second-order distance – presents design and analysis issues. For example, design analysis of player experiences – to study player experiences in relation to the game rules – is challenging owing to second-order distance. We've developed methods to address the design analysis of experiences (Dhamelia and Dalvi, 2021) based on the nature of these in-game experiences (Dhamelia and Dalvi, 2022). A thorough understanding of these problems is necessary to understand the fundamental structural aspects of games like mechanics, mechanism, genres, aesthetics, gameplay, aesthetics, play styles, etc.

Several references and group papers marked as *** are important for understanding this area and should be read and analysed meticulously. Candidates should be familiar with concepts such as mechanics, gameplay, themes in games, games as systems, and aspects of gameplay. Appreciation of the narratology versus ludology debate is expected, along with a broad perspective on various gaming genres acquired from playing at least 30 games, excluding common ones like Chess, Carrom, Ludo. The recommended course on game design can be studied here: https://onlinecourses.swayam2.ac.in/aic20_ed01/preview

Brief for a research proposal

Candidates can propose research projects on topics such as:

1. Playtesting: cultures and methods of playtesting board games.
2. Game balancing: theories, methods, and tools for balancing games.
3. Game formalism: Research on the formal aspect of games where games are treated as formal systems.
4. Genre problematization and formation: What is a genre when it comes to games? How are genres formed? What are different ways of classifying games? Are the current genres sufficient? How do genres evolve?
5. Design analysis of Player experiences: Methods to study player experiences in relation to the game

6. Design Processes in Games: Processes of designing formal, and experiential aspects of games. Respectively, one can ask questions such as – how do designers think mechanically while designing the game? How do designers think about experiences while designing the game?

Candidates should acquaint themselves with key texts (marked **), including Rules of Play and Building Blocks of Tabletop Games, along with other principal texts such as The Ambiguity of Play and Game Design Workshop: A Playcentric Approach to Creating Innovative Games. A familiarity with concepts like mechanics, gameplay, game themes, and games as systems is essential, along with a deep understanding of the ludology vs. narratology debate. Candidates should also enrich their understanding of gaming genres by playing a diverse selection of at least 30 games and enhance their knowledge using the recommended online course on game design.

Expected background of the applicant

Applicants should have analysed group papers, read secondary references, and played at least 30 different games spanning various genres. A good understanding of mechanics, gameplay, themes in games, games as systems, aspects of gameplay, and familiarity with the narratology versus ludology debate is expected. Additionally, an enthusiasm to play and analyse gameplays from several perspectives will be highly advantageous as well as access to a variety of games.

Sample questions

- How do you think the mathematics of the game influence the mechanics?
- What is narratology versus ludology debate? Describe your position and argue for the same.

References

1. *** [Paper] Detailing the Ludic form: A Design Research Inquiry into Gameplay Aesthetics. Dhamelia and Dalvi. Link
2. *** [Paper] Pleasures in Games: Conceptual Analysis of Fun in Games. Dhamelia and Dalvi Link
3. *** [Paper] Designing Fun: A Method to Identify Designable Experiential Elements in Analog Abstract Games. Dhamelia and Dalvi. Link
4. *** [Paper] Gameplay Experience Sampling: A Protocol to Reduce Second-Order Design Gap. Dhamelia and Dalvi. Link
5. ** [Paper] Game Classification and Game Design by Elverdam and Aarseth. Link
6. **[Paper] A multidimensional typology of games by Aarseth, et al. Link
7. ** [Project] The 400 project by Noah Falstein and colleagues Link
8. ** [Paper] The Gaming Situation by Markku Eskelinen Link
9. * [Paper] MDA: A formal approach to game design and game research by Leblanc, Hunicke and Robert Link
10. ** [Book] Rules of Play by Katie Salen & Eric Zimmerman
11. * [Book] Building Blocks of Tabletop Games by Geoff Engelstein and Shalev
12. * [Book] Homo Ludens: A Study of the Play-Element in Culture by Johan Huizinga

Topic 3

Updating the user-usage model of technology adoption by emergent users

Description of the area

In the early days, the usage of information and communication technologies (ICTs) was limited to urban, office-going, educated, and western or westernised users. Only over the last 20 years though, ICTs such as mobile phones, smartphones and the internet reached the hands of the relatively poorer, the rural, the elderly, those with less education, and those who are otherwise disadvantaged. We will refer to these as "emergent users" (Devanuj and Joshi, 2013). This research topic is about understanding how emergent users adopt and adapt to ICTs.

Short review of the prior work and additional reading material

Based on field studies in India, researchers at IDC had proposed a two dimensional model of technology adoption by emergent users (Devanuj and Joshi, 2013). The first dimension was called "usage" in which we proposed five stages of use of ICTs by emergent users. We also identified barriers due to which hinder the progress of the users through the stages. However, we also discovered that the progress across stages was not uniform for all users — based on their abilities and contexts, some users were able to cross the barriers easily while others were not. Hence, we proposed a second dimension ("users") in which we proposed five types of users, each of which we described with the help of a persona.

However, the model is hardly set in stone. Smart design strategies can be used to help emergent users overcome barriers. For example, a few years later, we studied adoption of Whatsapp among emergent users in India (Balkrishan et al 2016), and found that interesting designs were already helping some emergent users leap across some of these barriers. We have done other projects where we found other interesting strategies to support emergent users. For example, (Joshi et al, 2008), (Joshi et al, 2011), (Joshi et al, 2012), (Joshi et al, 2014), (Robinson et al 2017), (Jones et al 2017), (Pearson et al 2019a), (Pearson et al 2019b).

As additional reading, the candidate may find it useful to also get an overview of the field through work of other researchers. For example (Ho et al, 2009) and (Dell et al, 2016) provide useful summaries.

Brief for a research proposal

While the principles may remain the same, the technology context of emergent users in India has evolved considerably since (Devanuj and Joshi, 2013) did their studies, with a much wider adoption of smartphones, cheaper internet bandwidth, and applications such as Youtube, Whatsapp and UPI based payments. We have been through demonetisation and Covid. In the research proposal, please suggest a method that you will use to go about redoing this research, come up with a more contemporary model and evaluate it.

Expected background of the applicant

Apart from having excellent interaction design credentials, the candidate needs to have a strong inclination towards fieldwork, ability to work with people, motivate them and lead them, and a strong background in qualitative research methods. The research will involve travel in India and lots of team interactions.

Sample questions

- Using the user-usage model as a basis, please explain why some users are able to do tasks fluently, while other users struggle to do it. To illustrate your point, give one example from your observations in real life situations.
- Give plausible explanations of why certain products were adopted by many emergent users in India (e.g. Whatsapp, Youtube, voice search, UPI payments), while several other technologies did not become as popular (e.g. SMS, MPesa, text search).

References

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- Devanuj Balkrishan, Anirudha Joshi, Chandni Rajendran, Nazreen Nizam, Chinmay Parab, and Sujit Devkar. 2016. *Making and Breaking the User-Usage Model: WhatsApp Adoption Amongst Emergent Users in India*. In Proceedings of the 8th Indian Conference on Human-Computer Interaction (IndiaHCI '16). Association for Computing Machinery, New York, NY, USA, 52–63. https://doi.org/10.1145/3014362.3014367 (also in drive)
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- Jennifer Pearson, Simon Robinson, Thomas Reitmaier, Matt Jones, Shashank Ahire, Anirudha Joshi, Deepak Sahoo, Nimish Maravi, and Bhakti Bhikne. 2019. *StreetWise: Smart Speakers vs Human Help in Public Slum Settings*. In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (CHI '19). Association for Computing Machinery, New York, NY, USA, Paper 96, 1–13. https://doi.org/10.1145/3290605.3300326 (also in drive)
- Jennifer Pearson, Simon Robinson, Thomas Reitmaier, Matt Jones, and Anirudha Joshi. 2019. *Diversifying Future-Making Through Itinerative Design*. ACM Trans. Comput.-Hum. Interact. 26, 5, Article 33 (October 2019), 21 pages. https://doi.org/10.1145/3341727

Some unpublished work done in IDC

- Devanuj's PhD thesis: http://hdl.handle.net/10603/539413
- Samadrita's MDes thesis P1

Topic 4

Supporting Health and Fitness with the Aid of Technology

Description of the area

The projects listed here focus on adhering to health and fitness (H&F) routines such as exercising, following an appropriate diet, and going for regular health check-ups. While these activities are crucial for well-being, many individuals encounter challenges in consistently adhering to these routines. Some of our work in IDC in this area has focussed on the older adult population of India (Rao et al 2020, Rao et al 2022, Rao et al 2023). Much other work has happened around the world, including for older adults, and we will encourage candidates to become familiar with that.

In this broad area of research, we are proposing three specific MDes by Research topics:

1. Information as motivation
2. Social Interactions and physical activities
3. Local context and health and fitness routines

While our focus so far has been on the older adults, you are welcome to select any other user group from the Indian context in any of the above topics. Below, we present a short review of the prior work and additional reading material and a brief for the research proposal for each topic. We encourage you to seek out more related work on your own.

1. Information as motivation

Information is considered "an initial prerequisite for enacting a health behaviour" and helps individuals in adherence and self-management of health (Fischer et al, 2009, Fisher et al, 1992). Several theories and models (e.g., Fisher et al, 2003) have highlighted the importance of information on health-related behaviours. There is growing research on using fitness technologies to promote healthy behaviour (Sullivan et al, 2017, Kononova et al, 2019). Fitness technologies, such as mobile health apps and wearable activity trackers, are designed to help people live a fit and healthy lifestyle. They can track information related to H&F, such as tracking steps, calorie intake, and heart rate, and could be proactively used for reviewing, reminding, sharing, etc. However, these technologies tend to focus primarily on monitoring activities such as sleep, calorie intake, and steps walked and do not offer much in terms of personalised, actionable advice. While studies have shown that continuous monitoring of physical activities motivates people to adhere to physical activities (Mansi et al, 2015, Puig-Ribera et al, 2015, Kononova et al, 2019, Laranjo et al, 2021), a critical research gap exists. There is a need for further investigation, specifically on the role of information in adherence to H&F routines. This is essential for refining the design of fitness technologies to better align with users' information needs.

Brief for a research proposal

Your MDes by Research proposal could explore some of these questions:

- Does information motivate people to adhere to their H&F routines?
- Can tailoring information based on an individual's health goals and preferences motivate people to adhere to H&F routines? How can fitness technologies be designed to utilize real-time information to prompt/nudge people?

- How do different formats of presenting health information (visual, auditory, textual) affect motivation to adhere to H&F routines?

In the research proposal, please suggest a method you will use to conduct this research.

2. Social Interactions and Physical Activities

Social interactions have been identified as a critical factor in increasing a population's physical activity (Mema et al, 2022). With respect to older adults, many studies (e.g. Buccoliero et al, 2014, Bhayana et a, 2021, Antony et al, 2023) have highlighted the importance of social interactions, emphasising their significance in the design and development of technology-based solutions. Even in the studies conducted in our lab, we found that "social interactions" have a significant influence on older adults' adherence to physical activities.

However, the motivation for social interactions may vary among people. Some individuals exhibit a high motivation for social interactions. At the same time, others maintain a moderate motivation, and some may not be inclined towards social interactions at all. Along with this, considerable diversity exists in individuals' physical activity levels.

We must understand people's social interaction types to design technology-facilitated social interaction strategies to improve adherence to physical activities. Therefore, the primary objective of this research is to develop a model that describes people's social interaction patterns in conjunction with their adherence to physical activities. Such a model will contribute to a nuanced understanding of the interplay between social interactions and physical activity and provide valuable insights for the design and development of technology-based solutions that cater to people's diverse social preferences and physical activity levels.

Brief for a research proposal

This MDes by Research project could address how individual variations in motivation for social interactions and physical activity contribute to developing a model that describes social interaction patterns of individuals and their adherence to physical activities, and how this model can inform the design of technology-facilitated social interactions to enhance adherence to physical activities. In the research proposal, please suggest a method you will use to do this research.

3. Local context and Health and Fitness Routines

While digital technologies are extensively localised today, including in complex contexts of developing countries and emergent users, and going well beyond the surface level elements such as location and language translation, such localization is uncommon in health-related technologies. Modern and global design solutions in this domain sometimes sidestep or completely disregard local practices. Because these designs often emerge in developed countries, these often do not accommodate the local contexts of developing countries. But designs do not exist in isolation. Integrating the local context in design ensures that the solution aligns with the culture, needs, preferences, and beliefs of individuals. Past studies (such as Peng et al, 2016, Pyae et al, 2016, Oi et al, 2022) have stressed understanding the local context and practices when designing technology-based solutions. These studies advocated for local practices in technology design for better adoption and effectiveness.

While many health and fitness practices have emerged from modern (mainly western) science, others have been passed down through generations or as part of local traditions all around the world. However, benefits of such practices may not have been empirically demonstrated by contemporary science so far. Hence, achieving

effective localisation is not trivial. However, we can draw inspiration from successful implementations of crowd-based, extensive localisation from other domains (e.g., Google Maps).

There is an opportunity to enhance local features of health and fitness applications by providing more contextual information. For example, we could provide information on nearby fitness facilities (e.g., parks, trails, gyms) or events (e.g., walking groups, exercise classes). Local food and cultural practices could be incorporated into personalised recommendations. Information on H&F based on local medical research and practices can also be provided.

Brief for a research proposal
Some of the research questions to address in this MDes by Research project include:

- How can technology-based solutions be designed to provide localised health and fitness information and to incorporate local health practices?
- How can a comprehensive database of local food and dietary practices be seamlessly integrated into technology-based solutions to provide personalised recommendations based on individual contexts?
- To what extent does incorporating local context (e.g., providing localised information on H&F, incorporating local food habits, local language, etc.) enhance adherence to H&F?
- Can localisation approaches in H&F technologies that have proven successful in one culture be validated and adapted for use in different cultural settings, and what modifications are necessary for effective cross-cultural implementation? (See (Oi et al, 2022) as an example).

In the research proposal, please suggest a method you will use to conduct this research.

Expected background of the applicant
All three research topics will often involve understanding or developing a theory about human behaviour, manifesting the theory into a practical design, converting the design into a working prototype, and then deploying the prototype to evaluate the theory. Apart from having excellent design credentials relevant to the project (e.g. visualisation skills or interaction design skills), the candidate needs to have the wherewithal to do all these activities independently or with some help. Most topics will require an inclination towards doing fieldwork, working with others and being organised and motivated for research.

Sample questions

- Using the H&F Adherence framework (Rao & Joshi, 2023) as a basis, explain how personalised information helps older adults adhere to their H&F routines. You can explain using any example from your own experience/observation in real-life situations.
- Briefly explain the Information-motivation-behaviour skills model (Fisher et al. 2003). Can the model be used to understand and predict H&F adherence behaviour?
- Briefly explain some of the motivators identified for long-term activity tracker usage in the Kononova et al. study (2019).

References

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Topic 5

Text input in Indian languages

Description of the area and a short review of prior work

Traditionally, English text entry researchers have reported input speeds ranging from 19 to 53 words per minute (WPM) or 95 to 256 characters per minute (CPM) (e.g. MacKenzie et al, 2002, Ruan et al, 2016, Gaines 2018, Ruan et al 2018). After adding speech, Ruan et al. reported 161 WPM (about 805 CPM) for English, 108 WPM (about 540 CPM) for Mandarin Chinese as compared to 53 WPM (about 265 CPM) and 38 WPM (about 195 CPM) without speech, respectively (Ruan et al 2016, 2018).

Text entry in Indian languages however, has posed challenges for several years, including low speeds and high error rates. Researchers have attributed these challenges to the complex structure of the abugida scripts. Early studies related to text input in Indian languages focussed on presenting a simple way to communicate the conceptual model of the typing interactions, and to minimise the cognitive load while typing (Joshi et al, 2004).

Some of the earliest quantitative studies reported text input speeds of only about 10 CPM (Joshi et al, 2011). Longer and more controlled studies with about 5 hours of practice per user still reported speeds between 35 to 45 characters per minute (CPM) on four keyboards (Dalvi et al, 2016). Ghosh et al demonstrated the upper bound of typing speed on the Inscript keyboard even among experts on contemporary keyboards was about 115 CPM (Ghosh et al, 2016). Some of these barriers could be broken with the help of voice input (e.g. Anu Bharath et al, 2017, Bhikne et al, 2018, Bhikne et al 2019). Also, see below some unpublished work related to text input for Indic scripts that was done in IDC.

A lot remains to be done and explored, especially with respect to technologies such as voice input, probabilistic modelling on touch screens, shape writing on touch screens, next-phrase suggestions, and many more ideas.

Brief for a research proposal

Not enough work has been done to improve the speed of text input and / or to reduce the number of errors made in the broad area of text input in Indian languages. There are potentially several MDes by Research topics that the candidate can propose. Here is a short list of current possibilities:

1. Designing a new keyboard / modifying an existing Indian language keyboard (could be a physical keyboard or a virtual keyboard) to include auto-correct with the help of probabilistic modelling
2. Designing a new keyboard / converting an existing Indian language keyboard to include Shape writing / Flow / Swype style text input for touch screens
3. Creating a dedicated hardware device (such as chorded keyboards)
4. Creating editing tools for Indian languages to speed up text composition. Ideas include spell checkers, lightning-compose-style text predictors, voice input systems etc.

Expected background of the applicant

Text input work requires students to have a strong multidisciplinary background. Firstly, the candidates need to have a strong background in interaction design so that they can design new interaction techniques. Secondly, depending on the chosen area they will need a strong background in software (such as Android development, AI / ML technologies, and / or hardware development) to create prototypes using the chosen technology. Thirdly, the candidates need to learn research methods for conducting studies and experiments.

Sample questions

- In the context of text input studies, what is the difference between corrected error rate and uncorrected error rate?
- List three challenges that are specific to text entry in abugida scripts.

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- Crowdsourcing (through Gamification) of Corpus Cleaning, Vivek Paul, 2019
- Cleaning Swarachakra Hindi word list through crowd based games, Tarun Mugunthan, 2020
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Topic 6

Design hybridization: An approach to design products / furniture / future devices with new narratives

Hybridity “displaces the binary logic through which identities of difference are often constructed” (Bhabha 1994:5) thereby de-hierarchicalizing and de-inferiorizing that which has been marginalised by the dominant discourse” — Dr. Homi Bhabha

Description of the area

Hybrid genres engage in a process of reflection, re-visioning, and subversion. They consciously blur or erase the boundaries between traditionally defined categories, such as history and fiction, tradition and contemporary, and Technology and craft. Justin Marshall saya that “I am interested in both the development of new making processes that creatively use digital tools and how these open up the possibility for new forms of localised and flexible working practices/businesses that link the post-industrial to the pre-industrial … opening up the potential to refigure the relationship between consumption and production in twenty-first-century culture. [2]

Our focus lies in the dynamic interplay among individuals, handmade artefacts, and technology. Craft, with its diverse definitions, revolves around practitioners deeply committed to achieving excellence. David Pye's concept associates craft with risk-taking, resulting in unique artefacts shaped by subjective decisions. The Industrial Revolution ushered in machine-driven production, diminishing the value of manual dexterity. Craft techniques are now seamlessly incorporated into contemporary art, fashion, and design and are even making inroads into technology and design research. Our aim is to explore the fusion of craft practices with digital fabrication, navigating the tensions between handmade and digitally produced artefacts. The ascent of digital fabrication technologies, notably 3D printing, presents both opportunities and challenges, reshaping materials, techniques, and our relationships with objects.[1,3]

Short review of the prior work and additional reading material

Students at the IDC School of Design have embarked on projects under the theme of design hybridisation and new narratives. One notable project involves merging the traditional craft of blowing glass with PV (Solar) technology to create a solution for watering plants in the absence of homeowners. Another project explores the combination of crochet with wire mesh controlled through technology. This global trend of design hybridisation is evident in the Hybrid Craft exhibition, showcasing 15 projects that uniquely integrate modern making practices with traditional crafts, placing them within the context of today's Maker culture [2]. You may study a paper DOI:10.1162/LEON_a_01093, and the papers put in the references.

Brief for a research proposal

The research focuses on exploring the principle of design hybridisation and its role in generating new narratives through the creative fusion of high and low-tech processes. It probes into the concept of detournement, considering the potential for cloning creativity by drawing parallels with biological models and applying this idea to design through technological advancements.

You may explore the possibilities of hybridization with the suggested topics or their equivalents.

1. Consider the fusion of contemporary manufacturing techniques like additive manufacturing/laser cutting/ CNC with traditional woven crafts such as bamboo or rattan.
2. Investigate the blending of handcrafted sheet metal techniques, like copper/brass craft, with modern processes such as kirigami and laser cutting.
3. Integration of handmade paper, particularly in crafting 3D shapes, with electronic components to craft new narratives.

The study suggests that the practice of cloning, in the context of design, has the potential to lead to innovation and the creation of new meanings. By adopting detournement as a method, the research would aim to investigate how recombining elements from diverse sources can promote creativity and introduce fresh perspectives. Additionally, the research must emphasise the significance of understanding cultural exchange processes and design hybridisation as an approach that connects diverse fields, including handcrafting, technology, sociology, and anthropology.

Expected background of the applicant

Apart from having excellent product design/craft/furniture design credentials, the candidate should display a strong inclination towards 3D-CAD software, form sensitivity, and a degree of familiarity to the proposed topic such as craft / electronics etc. The research aspect of the role will require a blend of theoretical and practical-based research involving hands-on work in the respective domain. The candidate will also be expected to create a range of products as part of their responsibilities along with a full paper and an exhibition..

Skill sets Preferred:

- Craft Skills relevant to the interested topics chosen while applying
- Design, sensitive to forms and aesthetic
- Have basic 3D CAD software skills
- Sketching and renderings
- Model-making and prototyping

It is preferable if the candidate has a backgroun in product design or furniture design.

Sample questions

- What do you understand by design hybridisation, cloning and detournement separately and their relations to each other?
- What are your views in the research of project examples of design hybridisation? And How does creativity vary from cloning creativity?

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Topic 7

Understanding the grammar of storytelling in virtual reality narratives

Description of the area

While a traditional film is presented using visuals that are bound to a rectangular frame, a VR film or narrative immerses the users in the story environment that appears to surround them. Although this new medium helps enhance the users' presence in the story world, it has also evoked important challenges for storytellers. VR narratives provide the viewers with the freedom to choose where to look and allow them to change their point-of-view (POV) constantly. This liberty for the viewers to frame the visual content themselves has questioned the techniques used in guiding them to appropriate story elements that convey the intended narrative as effectively as possible [1]. Researchers and filmmakers exploring VR film are evaluating new storytelling methods to create efficient user experiences. With the rising interest in creating and experiencing VR narratives, the traditional tools, techniques and principles are being reconsidered, leading to the definition of a new grammar of VR storytelling [1,2].

Keywords: *VR Narratives, Interactive Storytelling, Presence in VR, Human-Computer Interaction*

Review of the prior work and additional reading material

In previous studies, we explored this evolving grammar of VR storytelling. We presented the significance of perceptual (audio and visual) cues and their impact on guiding the users' attention to different plot-points in a VR narrative [2,3]. Connected previous projects at the IMXD Lab can be found here: imxd.in. The related research papers and publications are listed below.

The previous explorations were predominantly associated with linear VR narratives. A linear (pre-rendered) VR film (such as Dragonfly [2,3]) contains strictly one narrative but with the freedom for the users to change their perspective in a panoramic 'look around' mode, which is referred to as a 3-degree-of-freedom (3DoF) experience.

A 6-degree-of-freedom (6DOF) experience allows the user to not just 'look around' in the story environment but also 'move around' in real-time. A real-time VR narrative may have predefined story elements as well as elements that may require changes or updates depending on different factors, such as the POV and the user's position in the story environment. Two such projects at the lab that attempt to explore the 6DOF VR film experience are Manhole and Belonging.

A few studies on non-linear responsive VR films have also been conducted by the lab, such as Cinévoqué [4, 5, 6], where the experience uses pre-rendered 360 videos to present narratives that evolve according to the user's gaze.

Some additional readings on this topic are works by Brillhart J., Alger M., Fearghail C. O. et al., Vesterby T. et al. & Nielsen L.T.et al. [7, 8, 9, 10, 11] which have also been predominantly on 3DoF narrative experiences. Furthermore, some of the works by Slater, M., & Usoh, M. & Slater, M. [12, 13] delve into the concept of 'presence' in VR which are relevant in understanding how and in what ways VR experiences affect people.

Brief for a research proposal

This research will look at storytelling techniques explored in different kinds of VR narratives (especially 6DOF experiences) in order to propose potential new techniques or create guidelines for designing compelling VR narratives. The work will build upon the previous research on the grammar of VR storytelling explained above. The research proposal must include the direction for the research (identified based on the literature review), the objectives of the research, and the potential contribution of the research to the domain of virtual reality.

Here is a list of potential research questions/topics the candidates can propose:

1. What are the effects of visual and audio cues on guiding the user's attention?
2. Exploring the challenges of effective storytelling in a 6DoF VR narrative.
3. Research on interaction techniques that help design compelling VR narrative experiences.
4. Research on novel methods to test the effectiveness of a VR narrative (for instance, logging data to assess the user's POV and attention quantitatively).
5. Exploring perceptual prompts beyond audio-visual cues in VR narratives.

Expected background of the applicant

Applicants are expected to have done a literature study on this topic, gone through the shared papers and reviewed them. They must have a keen interest in conducting research, honing problem-solving skills and challenging oneself in new ways. It is preferable that an applicant has previously explored one or more of the following topics: Virtual Reality, Immersive Media, Interaction Design, Game Design, Storytelling, Space Design, User Interface Design, HCI, 3D Animation, New Media, Interactive Storytelling, and Visual Narratives.

Skill sets preferred:

- Skilled in basic design and visualisation tools/software.
- Have an understanding of XR: virtual, augmented, and mixed reality.
- Have basic software/programming skills (or are eager to learn) Unity / Unreal engine, (C#/C++/Javascript/Blueprint), WebXR

Sample questions

- In terms of experience, how do you differentiate traditional media of communication from new media or immersive media?
- How do visual and audio cues in VR narratives contribute to compelling storytelling?

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All the papers mentioned here, as well as a few additional connected papers, can be accessed from this link: Papers - VR Storytelling

Topic 8

Novel interaction techniques for augmented / virtual reality

Description of the area
Augmented Reality (AR) and Virtual Reality (VR) are novel technologies offering immersive experiences that blend the digital and physical worlds. However, much of the research in the field has been focused on the technology for providing the experience (such as tracking and display devices) rather than methods for allowing users to better interact with the virtual content being shown [1]. Environments have usually been limited to either passive viewing or simple browsing of virtual information. Several interaction techniques could be applied to the next generation of experiences, including tangible object input, multimodal interaction (gesture, haptic, voice) and mobile phone manipulation [1]. For instance, tangible interactions with the real world can provide intuitive ways to interact with virtual content. The common thread through these research works is the novel approaches to interacting with virtual / augmented worlds, commonly referred to as extended reality (XR).

Review of the prior work and additional reading material
Locomotion in VR is still a domain being experimented with. Even though one may require vertical locomotion, the physical spaces are mostly plain and horizontal. In these experiences, movement in the virtual space is accomplished using teleportation, gaze input or tracking in physical space, which is limited to a certain extent. A recent work [2] at the lab explored such an interaction for vertical locomotion involving both hands and feet.

Interaction in AR need not be limited to the screen but can question the methods that have been practised for years. A recent exploratory research by Rishi [3, 4] aims to explore the design space of using a second phone as a controller for mobile AR tasks such as pointing, selecting and drawing in 3D space. This not only allows the user to interact with AR elements more intuitively but also provides them with better control for accessing and manipulating the AR content. When it comes to AR, markers play an important role. While using multiple markers, inter-marker interactions are possible. However, they are currently limited to movement and placement. In this research work by Anurag [5], multiple inter-marker interactions in the tangible AR space are explored along with their use cases.

One of the key features of VR is its potential to create digital spaces as immersive as real spaces and, in turn, potentially recreate the dynamics of in-person meetings. This project [6] from the lab explores the use of mobile social AR experiences to support remote learning and collaboration. This opens up challenges and areas for further research in XR, such as defining natural interactions and identifying metaphors for audio and video interactions, personal chat, and breakout rooms, which sit well with the theme of recreating dynamics of “in-person meetings”.

Manipulating objects in 3D virtual applications today is largely done by keyboard and mouse. There are opportunities here as well to design new interaction methods that address common issues and move beyond inputs, which offer 2 degrees of freedom. In an ongoing project from the lab, the idea of using a 3D augmented reality marker for manipulating 3D objects on screen is also being explored.

Brief for a research proposal

This research will aim to look at existing interaction techniques and methods within the AR/VR space in order to propose new interaction techniques. The work may build upon the previous research works mentioned above or look at novel/unexplored techniques. The research proposal must include the direction for the research (identified based on the literature review), the objectives of the research, and the potential contribution of the research to the domain of XR.

Here is a list of potential research questions/topics the candidates can propose:

1. Exploring tangible interaction techniques for intuitive interactions in an XR environment.
2. Exploring interaction techniques that mimic or enhance natural movements and gestures.
3. Speculating on future interaction techniques for a specific topic (for instance, locomotion or text-editing) in VR.
4. Investigating potential applications of Mixed Reality or pass-through XR in the future.
5. How can we make XR experiences and devices more accessible to people?

Expected background of the applicant

Applicants are expected to have done a literature study on this topic, gone through the shared papers and reviewed them. They must have a keen interest in conducting research, honing problem-solving skills and challenging oneself in new ways. It is preferable that an applicant has previously explored one or more of the following topics: Virtual Reality, Immersive Media, Interaction Design, Game Design, Space Design, User Interface Design, HCI, New Media.

Skill sets preferred:

- Skilled in basic design and visualisation tools/software.
- Have an understanding of XR: virtual, augmented, and mixed reality.
- Have basic software/programming skills (or are eager to learn):
    - Unity/Unreal engine (C#/C++/Javascript/Blueprint), WebXR

Sample questions

- What are the goals and expectations of users from the augmented/virtual reality experience?
- What are some limitations of the current interactions in AR/VR?

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All the papers mentioned here, as well as a few additional connected papers, can be accessed from this link: Papers -Novel Interaction Techniques for XR.

Topic 9

Exploration of the language of virtual reality storytelling

Comparing Film Language in traditional Film & Video (screen format) with immersive media like a 360^{o} video and exploring equivalence in terms of process and tools like editing, filming, transitions, composition, real time v/s prerendered, screenplay, etc.

Description of the area

Film, as we know it, is made up of a linear sequence of individual clips with different camera angles or even locations transitioning from one to the next as cuts, dissolves, wipes, etc. which we still experience as a continuous narrative. These do not work as expected in an immersive format in the same way making it difficult to 'edit' a narrative.

Short review of the prior work

IDC has been exploring the new grammar of VR storytelling. Personally, in my work of creating a Virtual Experiential Museum on Ajanta (VEMA), we have created documentaries in traditional video format as well as immersive experiences using 360 videos and virtual 3D caves. While it would have been great to develop some of the documentary content in VR, the intrinsic freedom of choosing where to look and problems arising of changing POVs in a 360^{0} experience makes it challenging to develop a narrative intuitively with familiar tools in a standard video format like editing. So there is a need to understand what the equivalent grammar of editing would be in the realm of VR narratives. Some work done in IDC in this regard (Pillai J.S. and Verma M.) The ' In the Blink of a Mind' Series by Jessica Brillhart might give a decent short introduction to this topic link

Brief for a research proposal

Research would try and answer questions like

- What mechanisms could replace the tools of video in an immersive format?
- How can the new experiences of using these 'old' techniques become 'new' tools with new functions in the immersive format

Expected background of the applicant

Experience in one or more of the following areas would be essential

- Film making (especially editing)
- Developing VR content

Sample question

What are the problems in narrative storytelling that the following would have in a VR experience to transition from one point of view to another

- Cross Dissolve
- Fade out Fade in

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Topic 10

Tangible user interface designs for older adults

The convergence of various emerging digital technologies incorporating IOT (Internet of things) pose challenges for older adults in terms of usability (Sokullu et al., 2020). The heavy reliance on digital interfaces such as sophisticated smart phones integrated in the interior spaces, interconnected thermostat devices, self-guided vacuum cleaners, automated lighting, door entry/security systems, and kitchen and laundry appliances can burden older people with cognitive processing, leading them to abandon or replace such interactions (Ma et al., 2022; Pal et al., 2018; Shnain & Hussain, 2022; Sokullu et al., 2020). Therefore, it is essential to consider unique needs and preferences of older users when designing embedded technologies, ensuring that new innovations remain accessible, user-friendly and inclusive for users for healthy aging.

Tangible User Interfaces (TUIs) represent a novel interface type that bridges the digital and physical worlds. It has the potential to enhance the way people interact with and utilize digital information by leveraging their knowledge and skills in interacting with the physical world (Shaer, 2009). Research suggests that while there have been considerable studies into digital and physical interactions, particularly concerning the design of sensors, touch and gesture-based interfaces to minimize cognitive load (Bitterman & Shalev, 2002), there are notable research gaps in the specific context of Indian older adults with inadequate consideration of cultural and social aspects. Therefore, it becomes imperative to leverage user interactions with physical and tangible interfaces.

Previous studies have shed light on Tangible User Interfaces (TUI) and smart technologies in the context of ambient environments and innovative smart designs that combine modern computing, networking and systems communicating with numerous sensors. These innovations measure physical and physiological functions by monitoring activities and behavioural patterns of older adults that promise to improve residents' quality of life (Courtney, 2008; Balta-Ozkan et al., 2013). However, these studies have predominantly concentrated on product interventions, while there are research opportunities to explore interventions at the structural (auto-sensing facades) and layout (space circulation and furniture modification). There is a lack of data/studies exploring TUI in spatial and behavioural contexts, particularly in the Indian realm. Therefore, delving into TUI concerning space and behaviour holds significant potential.

Brief for a research proposal

Your MDes by Research proposal could explore some of these questions:

1. How can technology-based Tangible User Interface (TUI) solutions enhance the liveable space for older people ageing in place in context to safety and security?
2. How can TUI contribute to the needs of older adults in various domains such as healthcare, home design, furniture design, and product design, specifically emphasising safety considerations?

In the research proposal, please suggest a method you will use to conduct this research.

Expected background of the applicant

- The research topic will involve comprehending upcoming technologies with user behaviours and translating the theory into a tangible design.
- The candidate must demonstrate the ability to transform the design into a functional prototype.

- Must have ability for visualisation and interaction design skills.
- Must have basic knowledge of Arduino, Raspberry Pi, esp 32, etc.
- It is preferable that the candidate has explored languages such as C, C++ or Python, though this is not mandatory
- Must have basic understanding of sensors and actuators required in home Automation and tangible user interface design.

Sample questions

- Briefly explain overview of Tangible User Interface (TUI) design? Please include an example that highlights user studies and the development of a working prototype.
- Could you elaborate on an innovative application that integrates both digital and physical technologies for older individuals? Choose one area from healthcare, leisure, finance, safety, or security and provide an example that showcases the synergy between these technologies.

References

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Topic 11

Wearable devices for tactile interaction

Description of the area

The design of wearable devices for tactile interaction involves creating wearable gadgets to understand hand-product interaction. The wearable devices use a multi-sensory approach such as the measurement of touch and pressure response of the fingers and palm, and reflect it in the form of creative visualization. These wearable devices hold applications in product design, robotics, prosthetics, healthcare, human factors, virtual reality, and communication.

Short review of the prior work and additional reading material

There are multiple companies like Tekscan [1] and Pressure Profile Systems [2], which are commercially providing wearable devices for tactile interaction. However, they suffer from the drawbacks of being too expensive, low resolution, and lacking flexibility for being used in customized experiments. On the other hand, there are few research lab-based wearable devices available in the literature [3-6]. However, they are neither available commercially, nor they can be used to perform complex activities, nor they are designed to accommodate the natural flexion of the fingers and palm.

Additional Reading Material: Functional Tactile Sensors [7], The Grasp Taxonomy [8], The Hand Manipulation [9]

Brief for a research proposal 1

The current research project aims to design and develop a wearable device for tactile interaction that must be low-cost, high resolution, and can accommodate a wide range of form factors. Moreover, the current research project also aims to design a wearable device in such a way that the position of the embedded sensors on the fingers and palm leads to the maximum sensing area without compromising the natural flexion of the fingers and palm, during the performing of simple as well as the complex activities. The first version of the wearable device is already developed and refinement needs to be carried out on the above-mentioned aspects.

Brief for a research proposal 2

The current research project aims to create visualizations that effectively communicate patterns, trends, and insights derived from the tactile dataset. This visual representation aims to enhance user understanding and facilitate decision-making during the use of wearable devices. The challenge lies in designing intuitive and accessible visualizations that harness the full potential of the wearable device's capabilities, catering to diverse user needs and ensuring an optimal user experience in interpreting and interacting with the data.

Expected background of the applicant

Applicant should possess a background in Mechanical and Electronics Engineering. Applicant also has an understanding of prototyping, wearable technologies, and data visualization. The applicant with a track record of successful projects related to wearable systems or data visualization will be prioritized, showcasing their ability to innovate in this evolving field.

Sample questions

- What are the various types of hand grasps and manipulation actions?
- What data visualization tools do you find most effective for presenting complex datasets?

- How do you decide which type of visualization (e.g., bar charts, scatter plots, heatmaps) is most suitable for a given dataset and analytical objective?

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Topic 12

Adaptive patient transfer system for individuals with limited lower body mobility

Description of the area

Motor Neuron Disease, Paralysis, and Muscle Dystrophy are debilitating conditions that result in the weakening or loss of muscle control, significantly impacting the daily lives of affected individuals. These conditions are often irreversible, rendering patients reliant on caregivers for assistance in routine activities. While various aids such as wheelchairs, crutches, dressing aids, and communication aids exist to support patients, there is a notable gap in the availability of effective devices for patient transfer.

The loss of strength in both upper and lower limbs makes self-transfer challenging, necessitating the constant involvement of caregivers. Existing methods for patient transfer are limited, and the few available options pose risks of injury to both the patient and the caregiver. Furthermore, the process of transferring individuals in and out of wheelchairs or beds places undue strain on the caregiver's back, arms, and shoulders, potentially endangering both parties involved.

This project aims to address the critical need for an adaptive patient transfer device that can provide a safe and efficient solution for individuals with conditions causing muscle weakness or loss of control. By designing a practical and user-friendly transfer aid, we aim to enhance the independence and quality of life for both patients and caregivers, reducing the physical strain associated with patient transfers and mitigating potential risks of injuries.

Short review of the prior work and additional reading material

Previous work in this domain has been undertaken by students at the IDC School of Design. A notable project conducted by Mr. Santosh Kumar Sagar was titled "Designing an assistive transfer device for wheelchair-bound MND/ALS patients." Mr. Sagar's project report provides a comprehensive exploration of patient transfer stages, including a detailed user study. The report extensively analyzes key problem areas associated with patient transfer, shedding light on crucial insights. Additionally, the project delves into the examination of various products available both in India and abroad, contributing valuable perspectives to the understanding of assistive devices in this context.

Brief for a research proposal

The primary objective of this research proposal is to deploy an exploratory research method that incorporates both practical application and qualitative assessment. The focus will be on thoroughly conducting user research to gain insights into the challenges faced by individuals with limited lower body mobility during patient transfer. The ultimate goal is to identify design opportunities and develop innovative solutions that address the specific needs of this user group.

Possible topics:

- Patient transfer in hospital scenario
- Patient transfer in at-home context
- Patient turning and managing bed-sores
- Patient support for physio-exercises at home

Expected Outcomes:

- Comprehensive insights into the challenges faced by individuals with limited lower body mobility during patient transfer.
- Identification of design opportunities and articulation of innovative solutions.
- Practical and user-friendly assistive patient transfer devices tailored to the unique needs of the target user group.
- Qualitative assessment results providing valuable feedback for continuous improvement and optimization of the design solutions.
- Research paper based on the work done.

Expected background of the applicant

Candidates are expected to have a background in Product Design. Having an exposure to mechanical engineering would be an added advantage. The candidate must know 3D CAD modelling software.

Sample questions

- Based on your current understanding of the topic, what are the key challenges faced specifically in Indian context?
- Write a detailed design brief based on your current understanding of the pain points.

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