



# Sociotechnical Imaginaries of Digitally Altered Minds in 2050: Functions, Citizens, and Societal Tensions

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## Abstract

Adding to the list of practices permeated by digital technologies, in recent years, domains related to altered states of consciousness (ASC) (e.g. psychedelic experiences) have also seen an increasing number of digital implementations. While implementations at the intersection of HCI and ASC mostly represent weak signals, there is a need for anticipatory research to explore the possible implications of digitally induced altered states of consciousness (DIAL). To address this, we adopted the Futures Clinique method to map out DIAL-related sociotechnical imaginaries through two futures workshops, capturing collective anticipations expressed in narrative scenarios created by participants. These scenarios were then analysed using reflexive thematic analysis, revealing common themes and relationships between them across groups and implementations. The themes were categorised into three areas: (1) the societal functions of DIAL technologies, (2) the citizen types ("Subjects") shaped by DIAL, and (3) the societal tensions and contradictions arising around their use. Additionally, to explore the relationships between these themes we used network visualisation. This work contributes to the HCI field by providing the first study of its kind to explore the collective anticipations relate to futures of DIAL through participatory workshops. Furthermore, the emergent framework offers a broader contribution to HCI by providing a blueprint for portraying the implications of emerging technologies through collaborative speculation.

## CCS Concepts

• **Human-centered computing** → **HCI theory, concepts and models**; • **Applied computing** → **Law, social and behavioral sciences**; *Media arts*.

## Keywords

Speculative Workshop, Futures Workshop, Futures Wheel, Futures Table, Sociotechnical Imaginaries

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## 1 Introduction

The rapid evolution of digital technologies in recent years has introduced new dimensions into discussions of what it means to be human, when boundaries separating machines and humans are continuously being (re)negotiated. This discussion has emerged arguments that the current widespread adoption of ubiquitous computing has already rendered us cyborgs, and for some technology companies, the emerging horizon of neural implants and brain-computer interfaces is a logical continuation of this development trajectory. [35]. The cutting-edge neurotechnologies have the promise to revolutionise the understanding of consciousness, or potentially even to extend it in cases where digital alteration of consciousness is enabled [3]. While these technologies may offer novel implementations, the study of altered states of consciousness (ASC) dates back to the 1960s [38], with examples including hallucinations, transcendence, ego dissolution, and lucid dreaming [57]. As a weak signal of the trajectory toward digital induction of such experiences, there are already implementations at the intersection of digital technologies and ASC that utilise tools such as virtual reality (VR), artificial intelligence (AI), and flickering light stimulation [2, 24, 32, 53]. To encapsulate this emerging class of digital technologies, the term digitally induced altered states of consciousness (DIAL) was recently coined [3]. It represents a continuation of some individuals' efforts to achieve ASC, now through digital means rather than traditional methods such as the use of psychedelic substances or the practice of meditation.

Considering the future iterations of DIAL technologies enabled by the fast pace of technological development, there is an urgent need for anticipatory research into their effects on individuals and societies [3]. However, such academic efforts are underrepresented in the current literature, likely due to a lack of resources to study phenomena that do not have immediate societal effects. Yet, with the increasing complexity of variables influencing societies, the

field of futures studies has grown rapidly, offering methods to speculate about possible futures [29]. Especially participatory methods provide an alternative to the traditional approaches of anticipating future events by analysing historical data, instead involving diverse stakeholders in collaborative speculation about the future [20, 29]. This approach allows us to move beyond emerging technologies to identify weak signals and various collective anticipations, all of which significantly influence the future. The future does not simply happen; it is made. From this perspective, the current work explores potential futures of DIAL by utilising the futures clinique method [27] and reflexive thematic analysis [8, 9] to answer the following research question:

**RQ:** What do sociotechnical imaginaries of DIAL technologies reveal about shared anticipations regarding their functions and societal implications?

The current study offers several important contributions to research on DIAL, as well as to the broader field of anticipatory research of emerging technologies. As a methodological contribution, it provides a blueprint for combining the futures clinique and reflexive thematic analysis methods to study collective anticipation of potentially disruptive technologies. As a theoretical contribution, it offers a framework for understanding implications from three perspectives: the functions that the technology serves in society, its impacts on individuals, and the resulting societal tensions. The study also provides practical contributions to DIAL as an emerging research field. The alternative futures related to DIAL, generated during the workshops, represent the first attempt in scientific literature where the fifth pillar (creating alternative futures) of the six-pillar conceptual framework for futures studies [29] is addressed in the context of DIAL. The findings highlight key themes related to the collective anticipation of DIAL technologies, offering valuable insights into their potential functions, effects on users, and the societal tensions they may create, all of which should be considered in future development projects related to DIAL. Furthermore, the study promotes futures literacy by fostering futures thinking through participatory workshops.

## 2 Background

Throughout history, consciousness has captivated philosophers [36], religious leaders [41], and, more recently, neuroscientists [57], all striving to conceptualise its origin and meaning. Like consciousness itself, its altered variants have been subject to a myriad of interpretations. Arnold Ludwig first coined the term Altered States of Consciousness (ASC) in the 1960s [38], and since then, a range of perspectives has emerged from neurocentric approaches [54] to its cultural significance in rituals [60]. While academic understanding of the phenomenon has developed over the past several decades, practices aimed at expanding the mind have existed for millennia in the form of meditation and yoga [49], as well as ritualistic use of chemical substances [40]. In Western cultures, synthetic psychedelics have arguably been the most influential technology related to altered states of consciousness. Substances such as lysergic acid diethylamide (LSD) emerged nearly a century ago and later became central to countercultural movements of the 1960s, before being strictly regulated in the 1970s. In recent years, psychedelics

have experienced a renaissance, with promising results demonstrating their effectiveness in treating mental health conditions such as depression, PTSD, and addiction [18].

The history of understanding of altered states has been closely linked with technological development, and as societies have become more digitalised, this aspect of human experience has also acquired digital dimensions. To capture the developmental trajectory of using digital technologies in the context of ASC, the concept of Digitally Induced Altered States of Consciousness (DIAL) was recently introduced [3]. It serves as an umbrella term for the intersection of long-standing interests in and distinct public discourse trajectories in mind-altering and drugs on one side, and digital technologies on the other. The development and futures of DIAL are entwined with that of psychedelics. With biofeedback emerging as one of the earliest examples of digital technology proposed as a substitute for psychedelics in the exploration of the mind, following their regulation [43]. During the first wave of psychedelic experimentation, an innovation called the Dreamachine also emerged, utilising flickering light stimulation to induce visual hallucinations similar to those caused by psychedelics [55]. Currently, amid the resurgence of psychedelics, there is a plethora of novel digital implementations based on immersive technologies, artificial intelligence, and biofeedback designed to induce or mimic psychedelic and other ASC effects [25, 31–33, 53] alongside a growing number of ongoing scientific initiatives [56]. While currently limited by existing technological capabilities, there is a looming question of "what if" these technologies become increasingly disruptive, enabling experiences, practices, and wider impacts that challenge the very core of what it means to be human. These questions have been previously explored in the literature in relation to technologies central to DIAL, such as brain-computer interfaces (BCIs). Wong et al. [61] examined the futures of BCIs through design fiction, creating fictional digital media artefacts that illustrate potential trajectories for BCI technologies. While these design fictions effectively render elements of speculative futures into tangible artefacts, they do not encompass the full spectrum of sociotechnical implications (see [61]). Moreover, DIAL uniquely integrates such technologies with cultural meanings and practices surrounding drug use and mind alteration [3]. As a result, earlier speculations offer limited insight into DIAL as a full sociotechnical phenomenon.

Given the lack of earlier literature on the sociotechnical imaginaries of DIAL and the complex interplay of social and technological factors, the future of DIAL remains unpredictable. Rather than aiming for foresight, however, it might be more fruitful to explore the possible futures by drawing analogies between the present and historical events. This approach is common, especially when an individual's knowledge about a current event is limited [23], reflecting how we construct our worldviews and guide present actions. Indeed, the easiest way to understand a person's anticipatory system is to ask them to describe the future [42], and such descriptions are often guided by continuity and one's understanding of the related historical events. However, interpreting the future solely through the lens of history may limit our ability to recognise genuine novelty and anticipate unlikely possibilities [16]. In complex social systems, and particularly when it comes to tensions (e.g., individualism vs collectivism), subtle nuances in the development

of emerging, potentially disruptive technologies can have a significant impact [7, 30]. To mitigate the influence of individual biases in anticipatory systems, many futures studies methods adopt a participatory approach [20, 29]. By involving diverse stakeholders in discussions about potential futures, these methods help democratise the process of anticipation [20].

Gaining a holistic view of possible futures is especially meaningful to prepare for non-imminent impacts of a potentially disruptive technology, or any predictions about the future may be significantly misguided. One of the most well-known examples of a failed future prediction is the report by the consulting firm McKinsey for AT&T in the early 1980s, which estimated that the global market for mobile phones would be just 900,000 units. This projection was based on the then-poor quality of the devices and the high cost of making calls [12]. Predicting the future is difficult — so difficult, in fact, that modern futures studies and foresight methods do not aim to forecast a single future, but instead construct a map of possibilities. This can be achieved through co-speculation [13, 22] or creating or analysing sociotechnical imaginaries, which are widely-held, institutionalised narratives of the futures [30, 50]. Imaginaries are particularly useful as they demonstrate broad anticipation and readiness of different scenarios, potentially further highlighting possible so-called wild-card scenarios – perceived as less likely but highly disruptive.

One common form of documenting sociotechnical imaginaries is science fiction media. Many fictional narratives that involve manipulations of such fragile matter as human consciousness are "ustopian" [44] in essence as they describe social conflicts around DIAL. Sometimes technologies have real advantages for some and dangers for others, as in Charles Stross's *Glasshouse* [52] in which memory editing was both a source of saving mental well-being and a tool of propaganda and manipulation. Sometimes, the darkest scenarios exist only in the minds of people, who cause much more harm than the technology itself, as in Peter Watts's *Blindsight* [59] where a group of terrorists called "realists" were so afraid that people would prefer the ideal world of controlled dreams over the grey reality that they went to great lengths to prevent its use. Together with historical events, fictions and collective assumptions recursively build our imaginaries of futures and anticipatory readiness.

### 3 Method

Given the unpredictable futures of DIAL, the current study gathered data through two participatory workshops using the futures clinique method [27] to explore possible societal implications of DIAL through sociotechnical imaginaries. The workshops produced data in the form of narratives describing future scenarios arising from the emergence of DIAL technologies imagined by the participants. These scenarios were then analysed using reflexive thematic analysis (RTA) [8, 9] to identify overarching themes and understand their interconnections.

The first workshop, organised in the HCI conference Academic Mindtrek 2024, was attended by seven participants, while the second, organised at the new-media art conference RIXC Art & Science Festival 2024, had six participants. The participants were adults (mean: 31, range: 21–39) and experts or students in the fields of

human-computer interaction, media, and art. Participants were originally from ten different countries (United States, Finland, Germany, Iran, Latvia, Netherlands, Pakistan, Russia, South Africa, South Korea), forming a diverse demographic composition considering the sample size. 67% of the participants were familiar with the topic of ASC, while 42% were familiar with futures study methods. In the workshops, the groups were formed randomly.

#### 3.1 Futures Clinique workshops

Originating from the classical futures workshop developed by Jungk [58], futures clinique emphasises the exploration of provocative and imaginative future scenarios rather than focusing solely on mapping the most probable ones [27]. Accordingly, it was deemed the most suitable approach for the workshops, given the objectives of the present study.

Both workshops followed the same structure (see details in workshop proposal [45]). Participants were first introduced to the topic with a short presentation about key concepts (e.g. ASC and DIAL) and a **warm-up activity** (duration 30 minutes) in which the groups were asked to brainstorm future DIAL implementations by combining a digital technology with a specific ASC-related context of use (see in the Appendix A.1). **Session one** (duration 45 minutes) engaged participants in a futures wheel exercise to stimulate futures thinking and encourage broad ideation around the topic (see in the Appendix A.4). The futures wheel is a circular, layered representation of a series of implications related to a future-oriented question placed at the centre of the wheel [27]. During the introduction of session one, participants were familiarised with the PESTELE framework (Political, Economic, Social, Technological, Ecological, Legal, and Ethical aspects) [28]. They were also provided with a cheat sheet (see in the Appendix A.2) containing real-life, non-DIAL-related examples for each domain, which served as a scaffold for their ideation and ensured that the discussions addressed a diverse range of societal domains. **Session two** (duration 45 minutes) utilised the futures table (see in the appendix A.5), a table-based scenario-building tool where potential implications are organised into rows and combined to form scenarios [27]. Finally, in **session three** (duration 45 minutes), participants created narrative descriptions (see in the Appendix A.3) of different futures based on their futures wheels and tables [27].

#### 3.2 Reflexive Thematic Analysis

The narrative descriptions of futures produced during the workshops were analysed using reflexive thematic analysis (RTA) [8–10]. Two primary coders (the first and third authors) developed the initial codes using an inductive analysis approach, chosen due to the absence of established theoretical frameworks related to the topic. The codes were generated focusing on both semantic and latent levels of meaning. The former identified explicit implementations and implications of DIAL in the scenarios, while the latter focused on finding broader meaning behind them in socio-cultural contexts. It should be noted that finding these meanings occurred through the prism of the authors' backgrounds. All of the authors are HCI researchers who have had several years of experience in researching DIAL. The authors have personally tried a number of current examples of DIAL technologies; however, without any agendas related

to the development of these technologies or conflicts of interest affecting the analysis. The themes were constructed through three iterations of coding and discussions with all authors. As a basis for finding the patterns across the dataset (see chapter 4, page 78 [10]), iteration of codes and themes ensured the following criteria were fulfilled: 1) each theme under each category must be based on two or more different codes, and 2) each theme must appear in at least two groups of scenarios. The latter was imposed to diminish overrepresentation in the results stemming from scenarios from a single group of participants; rather, we aimed at finding common themes and relationships between them across groups and implementations. After this, the codes were organised into themes under three categories: 1) *Functions* DIAL technologies fulfilled within the society; 2) *Subjects*, or citizen types, created by DIAL, and 3) *Tensions*, or contradictions, that emerged around DIAL. To examine the relationships between themes, we used network analysis [5] to visualise how the identified themes relate to one another.

## 4 Results

In line with our RQ, the results of the thematic analysis are comprised of DIAL implementations around which the scenarios were built, the three aspects of Functions, Subjects, and Tensions, as well as associations between them.

### 4.1 Implementations

The implementations brainstormed by the workshop participant groups as bases for building the futures scenarios ranged from wearable devices to ingestible chips. Explicit and implicit information found about the implementations offers varying degrees of specificity in the scenarios. For example, the exact mind-altering mechanism is often missing, but the participants rather focused on the effects the technology would have. The five resulting implementations and their general context of use as defined by the participants are as follows:

- A ring capable of affecting the user's brain activity used to experience and learn about nature following an environmental catastrophe.
- Advanced XR glasses used for religious and spiritual experiences, overcoming the fear of death through afterlife simulations, and sexual experiences.
- Implanted brain biochip for humans and animals, enabling enhanced inter-species communication and understanding.
- Advanced biofeedback system allowing users to program dreams, serving a range of uses from therapeutic to terrorism-related activities.
- Ingestible biochip that temporarily alters the user's state of consciousness for medical, recreational, and spiritual purposes.

### 4.2 Functions

Firstly, we examined how the DIAL implementations were imagined to be situated in the wider sociotechnical realities of the speculative worlds, and what kind of functions they held. Three distinct themes were constructed – Expansion, Containment, and Displacement.

**Expansion.** In many of the 18 scenarios, DIAL technologies were imagined to expand or augment human capabilities and experiences. Some presented implementations that provided tools to digitally restore access to experiences: *"people are using it to experience the beauty of nature before it was destroyed in The Cataclysm!"*. Others presented technologies that offered alternative digital tools for different already existing functions: *"people are using it to experience and learn."* Mostly, the imagined DIAL technologies enabled completely new capabilities and functions: *"The Dream Machine 3000 came out of nowhere, allowing us to program our dreams"*.

**Containment.** Some participants speculated potential futures in which DIAL technologies served as tools to, in one way or another, control individuals or entire populations. The contexts range from dominant powerful companies exerting control over users (*"The company has full population control... The world is in a strange state because people are slaves to the system"*) to the elite, such as political, exerting disguised forms of manipulation and restriction: *"(...) soon politicians started using it for their political means. We slept and dreamed of their promises, but we couldn't choose or elect."*

**Displacement.** Alongside implementations whose effects were mostly rooted in material reality, some scenarios imagined societies where DIAL technologies enabled complete immersion into the digital world: *"Those using the rings develop new ecosystems within the shelters that resist real ecological recovery."* On the other hand, Displacement sometimes involved the transformation of humans and a redefinition of what it means to be human, effectively detaching users from the non-digital, primary reality: *"Luckily, scientists found how to make people live forever in the digital world, creating a new 'form of synthetic life'"*.

### 4.3 Subjects

The second category of themes is Subject. These five themes – Dreamer, Transcendent, Post-Human, Citizen-Cog, and Rebel/Hacker – reflect the effects of DIAL on its users, specifically the kinds of citizens they are as a DIAL implication.

**Dreamer.** Sometimes, DIAL users become escapists, comfort-seekers, or citizens disconnected from their wider social and political environment: *"Desperate people seek relief from the fear of death"*. While in some cases comfort is actively sought through DIAL, in others the behavioural changes took hold on their own: *"People's well-being improves because they use the rings, but they become reclusive in their ring-driven realities."*

**Transcendent.** Somewhat in contrast to the Dreamers, Transcendents use DIAL for improving their well-being, elevating themselves spiritually, or enhancing their mental capabilities. *"The sheer versatility of it would push the brightest minds to come up with improvements to great success"*.

**Post-Human.** DIAL technologies also resulted in re-engineered humans, sometimes with undefined specificities, (*"Over time, the ring wearers start to transform based on how they live with their ring realities, forming a new race of people."*) or a creation of immortal humans with their consciousness stored and mediated through DIAL: *those who follow its instructions are allowed to live forever, supported by ring technology, while others are allowed to die.*

**Citizen-Cog.** Either through top-down control or secondary implications of DIAL, some users are described as becoming servile

citizens for the sake of optimisation, productivity, and order: *"The company has full population control. (...) The world is in a strange state because people are slaves to the system."*

**Rebel/Hacker.** In contrast to the pacified Citizen-Cog, this theme depicts subversive users – those who repurpose DIAL technologies to rebel against a wider system or a controlling entity. They are often not solely individuals but rather form communities of resistance. *"On election day, people don't vote at all. People want to decide for themselves, and the workforce overcomes the governments."*

#### 4.4 Tensions

The third portion of the results consists of themes focusing on speculative technosocial tensions around the recognised Functions and Subjects, as critically reflected in the scenarios – Control vs. Autonomy, Escape vs. Engagement, Progress vs. Dehumanisation, Authenticity vs. Simulation, Unification vs. Fragmentation, and Runaway vs. Predictable tech.

**Control vs. Autonomy.** The question of autonomy, or lack thereof, over adoption, use, and terms of DIAL technologies' use was brought up in the participants' imaginaries. *"Therefore, politicians enforced the use of the ring for everyone; it is a must."* Although scenarios often implemented overt control of DIAL towards population control, in one example DIAL was instead used to initiate a revolution by waking the population up from their brainwashed state, reflecting lack of autonomy in use but lack of malice at the same time: *"So the shadowy figures devised a plan to distribute the bots in order to first increase the intelligence of the population and snap them out of their hypnosis..."*

**Escape vs. Engagement.** As in contemporary society, the imagined societies faced their own challenges, including environmental destruction, slavery, wars, and inequality. The scenarios presented two types of responses to these tensions – Whether DIAL technologies supported citizens to face the reality head-on and try to deal with the issues (*society was improved throughout, and the economy grew tenfold. (...) They cleaned their cities, and the shadowy figures became responsible for all citizens, as well as their issues.*), or retreated from them, sometimes to parallel digital worlds: *"Those using the rings develop new ecosystems within the shelters that resist real ecological recovery."*

**Progress vs. Dehumanization.** As a technological advancement, DIAL was imagined as both enriching the human experience and impoverishing it altogether. For example, DIAL could be a means to improve understanding of differences and promote inclusion through empathy-building: *"(...) resulting in increased diversity of technology for different forms/bodies."* On the other hand, it is sometimes described as altering power structures and increasing the social divides, resulting in dehumanisation: *"Humans are not allowed to walk free anymore and have to live in factories."*

**Authenticity vs. Simulation.** As a mind-altering technology, DIAL implementations seemed to often offer perceptions of mediated realities, revealing the issue of what is a "true", authentic experience and reality and what a (lesser) simulation, and finally how these are valued and negotiated by users and wider societies. For example: *"For one group, they have entirely abandoned the ring. Instead, there has been technology developed for physical social*

*interaction. Thus, while well-being without the rings decreases, people see each other more."*

**Unification vs. Fragmentation.** Considering the potential implications of DIAL, such as self-enhancement or opening opportunities for experiences and work, it is unsurprising that they were perceived as having the potential to bring people closer together as well as deepen (digital) divides. Divides were related to, for example, resistance to using DIAL or its cascading implications (*"War caused economic growth. Although, civilians experienced class separation."*). Unification reflects coming together between people, such as building communities with DIAL use or opposition as the common ground, or even between human and non-human worlds *"But in any case, the cooperation we've achieved not just between ourselves but with nature, has come with its rewards, and this might be the closest thing to global harmony we might get."*; however, unification is not only related to bottom-up initiatives, but is also found together with top-down suppression of the population (*"Politicians kept changing, their promises evolved, but we became indifferent"*)

**Runaway vs. Predictable tech.** Whereas some DIAL technologies are imagined and represented with a clear and predictable use and effect pattern, some scenarios depict the question of unintended, subversive, or manipulative patterns. This is often reflected through a trade-off of sorts, where the effect DIAL was designed for is overshadowed by, for example, an unpredicted side-effect (*"As a result, the ring led to an increase in well-being but a decrease in social interactions, even though the newly-developed technology enhances physical and social interaction."*). Sometimes, the broader implications of the mass adoption of DIAL interfere with the previously stable institutional and ethics structures governing the society: *"People are not going to the places of worship, so people get more free land. Religious organisations sue XR God. People are less concerned about religious ethics, so they are using neuro-sex-link to have sex with minors, and do tabooed stuff."*

#### 4.5 Relationship Between Themes

The three aspects of DIAL technologies in speculative scenarios – Functions, Subjects, and Tensions – were captured and systematised based on how they are used, who uses them, and what the broader implications of their adoption are. However, to be able to answer our RQ we further examined relationships between these themes collectively. For this purpose, we used a network visualisation (Figure 1) as an intuitive depiction of complex associations. However, to improve readability by reducing noise and appropriately representing significant connections, we imposed a data filter for the purpose of visualisation, similar to when constructing themes. As the totality of scenarios was created by five groups of participants, we were more interested in connections across them than those stemming from the same group of people, as it could have unjustly overemphasised dominant narratives from a single group.

Associations between themes included in the final representation are thus based on it appearing across at least two groups (i.e. more than one group of people imagined a scenario where the two themes are found together; for a legend of the representation of the number of groups in which an association is found, see Figure 1). This resulted in Displacement and Post-Human themes being completely omitted from the graph, indicating that their connections with

other themes are very dispersed and ephemeral, with combinations appearing only in single scenarios.

Moreover, we implemented a spring layout, where the distance between the nodes (ie themes) emphasises the frequency of their appearance across groups of participants and their scenarios. Finally, although we aimed at the graph primarily representing strong associations recognised by multiple participant groups, the thickness of the connection lines corresponds to the total number of scenarios in which the association appeared *across* all participant groups. Therefore, the combination of line a) type, b) thickness, and c) length enable an overview of major patterns in the network at a glance, both within- and between groups.

While analysing the network, a few clusters arguably stand out as prominent: the *central cluster* with a strong and closely-knit set of themes appearing prominently across scenarios, the upper right cluster with somewhat lesser connections but strongly intertwined themes (*median cluster*), and the two clusters on the left and lower ends of the graph with somewhat marginal but broad connections (*marginal clusters*).

When it comes to the *central cluster*, it is notable that the notion of Expansion of human capabilities and experiences with DIAL technologies has often been found together with the contradiction of Unification/Fragmentation of communities and societies in scenarios by all five groups of participants. At the same time, it appears to be the only such constant across groups and themes. However, most of the connections in this cluster are almost as strong, with four groups often imagining them in various configurations together with other themes. It is interesting to note, however, that this central cluster is composed mostly of Tensions, indicating primarily that they are often found together rather than in isolation; additionally, amongst all Functions and Subjects themes, only the one relating to the Expansion or augmentation of human capabilities, senses, and experiences is found here at all.

Similar to the central cluster appearing to revolve around Expansion and various Tensions, the *median cluster* is created around the idea of DIAL technologies serving the Function of user or population control (Containment) and the resulting subjugated non-agentic type of citizen (Citizen-Cog). While these two themes are closely related in their meanings, it is notable that they do form the base of a distinct cluster with at least two major tensions - that of agency and autonomy, or lack thereof, in using DIAL technologies (Control vs Autonomy) and how that use is associated with progress of and benefit for humanity as a whole on one hand, and potential depriving individuals of their positive human qualities or human rights (Progress vs Dehumanisation).

Finally, the two *marginal clusters* emphasise relatively prominent themes associated with several others but not closely intertwined. On one end (bottom of the visualisations), Dreamers as disconnected or escapist citizens that are users of DIAL are loosely connected with the question of Authenticity vs Simulation, while both relate to Expansion and different Tensions. On the other end (left-hand side of the visualisation), subversive citizens (Rebel/Hacker) are related to the same Tensions of Engagement and Fragmentation as Dreamers, but also Progress vs Dehumanisation. In that sense, Rebels are positioned opposite to subjugated Citizen-Cogs. Finally, the use of DIAL technologies resulting in enhanced citizens (Transcendent) shares some of the connections around the Function

of self-improvement (Expansion), such as the issues of escapism, digital divide, and predictability of implications of technologies.

## 5 Discussion

The current work explored collective anticipations related to digitally induced altered states of consciousness (DIAL; [3]) through sociotechnical imaginaries [30, 50] created in participatory future clinique workshops [27], resulting in five DIAL implementations and related 18 scenarios developed by five groups. We analysed the narratives using reflexive thematic analysis and identified themes relating to the Functions, Subjects, and societal Tensions and implications of DIAL. Finally, the complex associations between the themes were evaluated with a network representation. The current work contributed to the emerging field of DIAL by looking beyond existing implementations discussed in the literature [25, 31–33, 53] by imagining future iterations of these technologies. Furthermore, it offers deeper insights into the speculative societal implications of these technologies (see [61]), particularly in relation to DIAL's unique combination of cultural meanings associated with digital technologies and drug use.

Findings of this study suggest that anticipations related to DIAL are primarily related to the expansion of human capabilities, the containment of populations through control, and the potential displacement of human consciousness and society into digital existence. These Functions led to the identification of five archetypes of citizens, characterised as users who: become escapist disconnected from wider social and political environment, transcend beyond normal human conditions, are biological re-engineered or digitally immortal, are obedient and potentially suppressed by the external power, or oppose existing power structures through the use of DIAL technologies. The identified functions and citizen types were complemented with in six societal tensions: the use of DIAL was imposed or voluntary; citizens reverted in escapism or addressed societal issues; DIAL technologies advanced progress or led to the deterioration of the human experience; people lived in artificial or material realities; DIAL resulted in population unification or fragmentation; and the implications of DIAL were foreseen or resulted in wide disruptions.

The analysis of the relationships between themes revealed that participants see DIAL predominantly as a tool to expand human capabilities and as a driver of progress. However, progress generates tensions regarding resource distribution, potentially leading to instability depending on citizens' willingness to challenge or change the system. The central cluster of themes is connected to surrounding clusters that address matters of containment, obedience, and control; escapism into artificial realities to avoid societal problems; and societal transformation through either the transcendence of the population working toward a better future or rebellion against existing power structures.

### 5.1 Narratives in Relation to Surrounding Literature

The future scenarios created in the workshops aimed to explore novel and provocative ideas related to DIAL, in line with the futures clinique method [27]. However, anticipatory systems are influenced by historical events, current media artefacts, and the broader

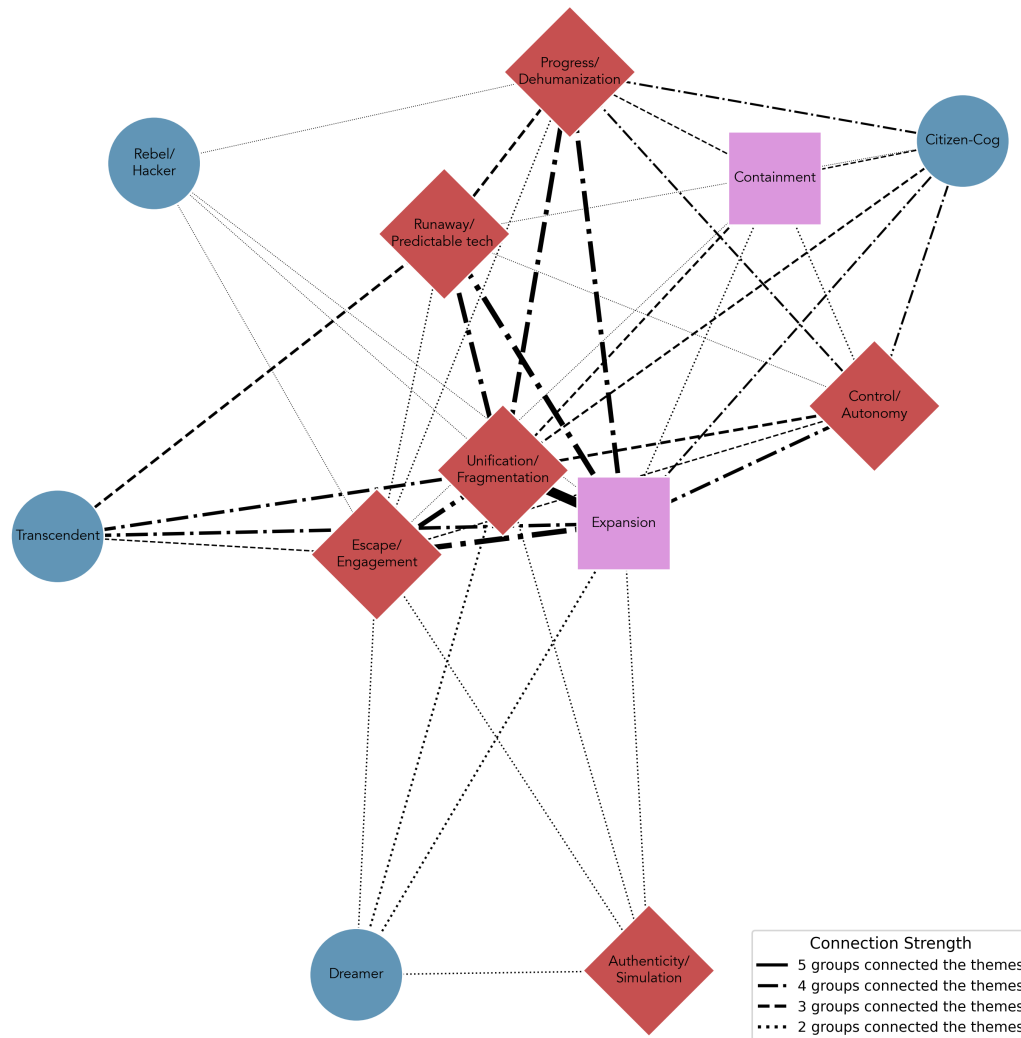


Figure 1: Network of themes visualised with spring layout.

societal context, all of which significantly shape future-oriented sociotechnical imaginaries [42]. Therefore, the themes discussed in sociotechnical imaginaries of the current study reflect current societal tensions. While those imaginaries that emphasise such tensions may appear dystopian compared to more harmonious, utopian visions, it is more productive to view them through a utopian lens, recognising that one's utopia may be another's dystopia [44].

**Functions** that DIAL serves in the described societies highlight the interconnections between DIAL and other ASC-related technologies. The theme Expansion connects the sociotechnical imaginaries of DIAL to meanings broadly associated with synthetic psychedelics and early indications of DIAL, such as biofeedback [18, 43]. Considering the prominence of this theme, the connection between DIAL and psychedelics appears evident, positioning DIAL as an extension of the list of mind-expanding technologies. This is also reflected in the current scientific literature, where the effects of

current DIAL implementations are related to psychedelics through adopting similar study designs [2, 25, 32, 53]. The concept of using DIAL for some type of control over citizens is also present in the current surrounding imaginaries and has historical precedents related to ASC technologies. While the narratives do not provide detailed descriptions of the mechanisms of control, a similar scenario is found, for example, in the fiction novel *Snow Crash* [51] by Neal Stephenson, where a computer virus makes people susceptible to orders through visual patterns. In non-fiction, the potential exploitation of mind-altering technologies was, for example, already evident when classical psychedelics were tested for mind control by the CIA [17]. The theme Displacement encompasses narratives related to mind uploading and the possibility of digital immortality, both of which have been essential parts of transhumanistic ideology [4, 6]. In popular culture this has been explored through works such as Greg Egan's *Permutation City* [19], which explores the concept

of rendering the human brain into a digital self-conscious format. Ideas of DIAL Displacing users suggest an expansion or division of society into material and artificial realities; however, this division does not initiate major conflicts between the two groups. In the *Blindsight* [59], Peter Watts addresses a similar possible future, although in his depiction, total escapism into artificial reality is perceived as evil, and efforts are made to stop it.

**Subjects** also reflected similarities between DIAL and other ASC-related artifacts. For example, the escapist and dissociative nature of Dreamers can be interpreted as echoing Timothy Leary's (in)famous phrase "Turn on, tune in, drop out," which became popular during the counterculture movement of the 1960s. The name of the theme Transcendent was largely derived from identified similarities between the descriptions in the narratives and the effects people seek through various forms of meditation, such as well-being, emotional balance, and spirituality [46]. The theme Post-Human, in some cases, reflects similar motivations as Dreamer and Transcendent, while situating the subject in an entirely new artificial environment, free from the constraints of material reality. The subjects Rebel/Hacker and Citizen-Cog, in turn, are not solely connected to ASC practices but reflect broader sociocultural aspects related to digital technologies. Since the introduction of the internet, hackers have utilised its potential to challenge societal power structures [48], making the emergence of this theme somewhat predictable also in the context of DIAL. Similarly, Citizen-Cog echoes the current use of information technologies for population control. For instance, in China, big data and various surveillance technologies have been used to create a social credit system as an attempt to regulate citizens' behavior [37].

Similarly, **Tensions** related to China's social credit system [37] are also reflected in the narratives of the current work. Many of the scenarios explored the theme of Control vs. Autonomy, particularly focusing on tensions between imposed and voluntary use of DIAL. This example is also closely connected with the theme Progress vs. Dehumanization. While big data is often compared to oil as a driver of progress in contemporary societies, there is also a downside, as it can arguably lead to dehumanization, as in China's example. While the tension Control vs. Autonomy appeared in the narratives, either as technologies explicitly designed for control or later exploited for political power, none of the scenarios presented the perspective of restricting or limiting the use of DIAL, as is currently being discussed in relation to social media platforms in the Western societies [14]. The tensions Runaway vs. Predictable Tech and Authenticity vs. Simulation are closely connected to current concerns surrounding AI. Contemporary AI chatbots are beginning to blur the boundaries between genuine and artificial relationships [34], and in various future imaginaries, AI is feared to act autonomously, potentially leading to so-called runaway AI [15]. As the tensions within sociotechnical imaginaries extend on those found in current sociotechnical realities, similar patterns can also be seen in how people address these issues. This is reflected in the theme of Escape vs. Engagement. Technological development in the post-industrial era has been one of the drivers of climate change. As the urgency to address this issue increases, some parts of the population respond by retreating into climate denialism as a way to escape reality, while others actively confront the crisis, even to the extent of enduring arrest to have their voices heard. This dynamic is also reflected in

the theme of Unification vs. Fragmentation. Societal issues related to technological development can foster the formation of strong collective movements aimed at addressing shared challenges, but they can also polarise society further to the point where meaningful dialogue becomes nonexistent.

While the narratives highlight many aspects that are easy to anticipate to appear, there are also some notable connections that are absent. One of these is addiction, which, in a physiological sense, does not appear in any of the scenarios. Discussion of potential addiction in the context of DIAL is important for several reasons. First, examples such as the auditory phenomenon of binaural beats, considered a proto-DIAL technology [3], sparked moral panic a decade ago and were framed as 'digital drugs' [1, 21]. Binaural beats have not been proven to cause physiological addiction, illustrating how the language used to describe new phenomena can significantly shape public perception. In this case, the term 'drugs,' carrying heavy negative connotations, influenced how an otherwise poorly understood phenomenon was received. Second, the absence of addiction in the scenarios is notable given the addictive nature of other disruptive digital technologies, such as mobile devices and social media [47]. Considering how prominently addiction features in discussions about digital technologies more broadly, its absence in the DIAL scenarios is itself a meaningful finding. This absence could be interpreted as a reflection of changing societal attitudes toward psychedelics, with DIAL being framed more positively, echoing the 'Cyberdelic' agenda [26]; however, given the various societal tensions raised in the narratives, this seems unlikely. As a reference for what a sociotechnical imaginary involving DIAL and addiction might look like, the Black Mirror episode *Common People* [11] offers an illustrative example where the entire existence of the main character depends on DIAL technology. In addition to complete dependence, there is a feature that artificially enhances pleasure (similar to chemical drugs), ultimately leading to signs of addiction, as it becomes the only remaining source of enjoyment.

**The network** of themes highlights the interconnections between the functions, subjects, and tensions associated with DIAL. The three identified clusters suggest three major directions of imaginaries for DIAL within the collective anticipations of the participants. The central cluster, which is the most interconnected, can be interpreted as narratives in which DIAL is adopted to expand human capabilities, resulting in increased capabilities and resources. The desire to improve is in the core human condition, and the driver of this is often the adoption of new technologies [6]. This, in turn, gives rise to tensions concerning the digital divide, which implies an unequal distribution of access to technology in society, fueling fragmentation [39]. Depending on how people respond to potential injustices and how DIAL is integrated into society, whether in alignment with its intended effects or not, this trajectory may lead to societal progress or contribute to further fragmentation. Moreover, the median cluster presents narratives in which DIAL is either initially adopted or later exploited as a means of population control, reflecting a similar development trajectory currently present in China [37]. Its connection to the Rebel/Hacker theme introduces two potential development paths: whether citizens accept this fate or choose subversion and reappropriate the technology. Finally, the marginal cluster suggests trajectories in which DIAL is adopted primarily as a means of escapism, allowing individuals to

retreat into digital realms as a way to avoid or relieve the pressure of individual issues or pressing societal challenges.

## 5.2 Limitations and Future Research

The major limitation of the current work was the limited amount of data. During the coding process, it became apparent that data saturation had not been reached, although it would have been unlikely in a single study as the scope of DIAL and its implications are vast. This is exemplified as some arguably relevant ideas appeared only once and were not sufficient for forming a theme. For instance, in one of the scenarios, there was a notion that DIAL became part of everyday infrastructure, replacing IDs and payment methods. However, there were no more reliable examples to form a theme around this idea. Moreover, the introduced time frame of the year 2050 likely influenced the reach of implications, resulting in some themes being limited to only a few instances (e.g., Post-Human and Displacement). However, this limitation could also simply result from the small amount of data and limited saturation.

Moving forward, there is a need for further mixed-method approaches for unveiling DIAL sociocultural imaginaries and build on the current research. This would also enable a more focused analysis of different aspects of DIAL as well as the "wild cards" (ie scenarios that exist at the margins and may be highly disruptive, despite being less probable). The current study broadly explored themes and their interconnections related to DIAL, laying the groundwork for future research to examine these nuances in greater depth within a narrower scope. In parallel with this future research agenda, the current work also points to other potential research trajectories, particularly those focusing on existing sociotechnical imaginaries found in science fiction media such as books, films, and television series. Finally, the current study outlined a preliminary framework of Functions, Subjects, and Tensions, which is applicable to other technosocial fields. It offers a grounding for future analyses of similar imaginaries and future development of the framework, which ultimately could make synthesising and comparative work more systematic towards understanding our collective anticipatory technosocial imaginaries and consequent resilience to disruptions.

## 6 Conclusion

This study is the first to apply participatory futures methods to explore sociotechnical imaginaries related to digitally induced altered states of consciousness (DIAL). The dataset comprises 18 narrative descriptions of futures shaped by DIAL, collected during two Futures Clinique workshops. Reflexive thematic analysis (RTA) was employed to identify themes across three distinct layers that characterize potential futures of DIAL: Functions, Subjects, and Tensions. The first layer focuses on the practical functionalities and effects of the technology; the second highlights its impact on users; and the third reveals societal tensions arising from the adoption of DIAL. Additionally, the study illustrates the interconnections among these themes through network visualizations, uncovering patterns in how DIAL technologies are anticipated and imagined.

This research makes a significant contribution to an emerging field where existing literature has largely focused on technological implementations, often overlooking broader societal implications. The insights generated offer practical value for the design

of future DIAL technologies by helping designers and developers anticipate potential unintended consequences. Beyond its specific contributions to the understanding of DIAL, the study also provides a methodological and theoretical framework for future research into the societal implications of emerging technologies.

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## A Appendix

### DIAL IMPLEMENTATION

Technology: \_\_\_\_\_

Context 1: \_\_\_\_\_

Context 2: \_\_\_\_\_

Context 3: \_\_\_\_\_

Sketch

Figure A.1: Implementations sheet

