The University of Haifa, situated in a unique setting between mountain, city and sea, offers a unique experience of exploration and learning while fulfilling an essential mission for Israeli society and the world. Having recently celebrated our 50th anniversary, we have set a clear goal for the future: we strive to be a symbol of excellence in teaching and interdisciplinary research in Israel and worldwide with an academic agenda focusing on social and environmental issues as part of its efforts to improve human welfare and Israeli society.

Its public engagement will play a key role in Israeli culture, geography and community life and as such, we will serve as a catalyst for change, promoting and developing leadership in public and business sectors, and encouraging everyday coexistence within Israel between members of various religious groups.

Thanks to the generosity and trust of the Bloom family, we established the Bloom School for Graduate Studies – an inspirational community for graduate and post-doctoral students who will play an active part in Israel’s intellectual leadership. The Bloom Graduate community is committed to the challenge of “thinking locally and acting globally” – to identify society’s critical issues and propose solutions both locally and globally.

Aligned with our broader mission of making higher education more accessible to students from the entire spectrum of Israeli society, the Bloom School for Graduate Studies aspires to be home to the best and brightest students from all over Israel and to play a key role in cultivating the next generation of inclusive academic leadership.

**Our academic framework aims to achieve the following goals:**

- To promote outstanding academic experiences and opportunities
- To encourage cutting-edge research and professional development that prepares graduates and postdocs for success in their fields of research
- To encourage academic discourse that addresses critical and controversial global and local issues.
- To foster the development of an academic community bound by a shared sense of identity and belonging to the university
- To enhance the prestige and visibility of graduate studies at the university, as well as the University’s competitiveness in attracting the best-qualified doctoral applicants
- To build on and continue to strengthen the relationship between faculty, students and the Graduate School, thereby enhancing comprehensive graduate education at the University of Haifa
- To build bridges between academia and community, from the city of Haifa to northern Israel, throughout the country and beyond, as we showcase the work of our young researchers

The October 7, 2023 attacks and the Iron Swords War have brought immense challenges and uncertainties into our lives. We acknowledge your resilience and strength in the face of fear, anxiety, stress and collective mourning. While we know it is not always easy to continue pursuing your education and research during such events, please remember that we stand with you and that you are invited to reach the Haifa academic community for support.

We hope that the focus on building a broad range of skills to enrich and support our research students will prove valuable to them.
Depression is a prevalent, disabling condition and a major health concern. The implications of depression extend beyond its core symptoms, affecting individuals’ social function, which is thought to create a vicious cycle contributing to its recurrent nature (Kupferberg et al., 2016). Research has shown that depressed individuals exhibit deficits in social reward and impaired empathic abilities (Kupferberg et al., 2016; Pegg et al., 2019). Moreover, a critical contributor to the perpetuation of depression is social disconnection (McKnight & Kashdan, 2009; Saris et al., 2017), as depressed individuals report fewer and lower-quality social connections, lower levels of perceived social support, and higher rates of social isolation compared to non-depressed individuals (Gariépy et al., 2016; Rueger et al., 2016). Therefore, identifying treatment approaches aiming to enhance social connectedness in depression holds promise for reducing depressive symptoms. However, most studies investigating social functioning in depression have focused on isolated participants conducting artificial tasks, lacking real social interaction and ecological validity needed to fully understand the underlying mechanisms.

Recent research on social functioning in psychiatric disorders has utilized functional near-infrared spectroscopy (fNIRS) to investigate brain function in real-life social and ecologically valid conditions (Quaresima & Ferrari, 2019; Shamay-Tsoory & Mendelsohn, 2019). fNIRS is a noninvasive functional neuroimaging technology, that allows assessing brain activity in natural settings. Importantly, it allows measuring brain activation of multiple participants simultaneously, offering the possibility of characterizing inter-brain coupling during real-life interactions (Babiloni & Astolfi, 2014; Koike et al., 2015; Quaresima & Ferrari, 2019; Shamay-Tsoory, 2022a). Using this state-of-the-art approach, recent studies have shown that inter-brain coupling in the inferior frontal gyrus (IFG), a core region of the observation-execution system, increases during social interactions and predicts the levels connectedness between participants (e.g., Cui et al., 2012; Pan et al., 2017; Shamay-Tsoory, 2022b).

I will conduct a series of two studies aiming at investigating the mechanisms underlying social deficits in depression. **Study 1** will characterize the differences in inter-brain coupling during social interactions between never depressed and currently depressed individuals. Given the reduced social connectedness observed in depression, I expect that currently depressed individuals will exhibit reduced inter-brain coupling of the IFG compared to never depressed individuals during an introductory and free conversation.

Following the establishment of deficits in interbrain coupling in depression, in **Study 2** I will take advantage of a novel dyadic neurofeedback platform design to train inter-brain coupling to examine the causal relationship between inter-brain coupling and depressive symptoms among major depressive disorder (MDD) patients. Potential participants will be clinically assessed, and those meeting the inclusion criteria will be invited to three training sessions. Each of the training sessions will be performed in pairs of never depressed participant and MDD patient, with random assignment to either active or yoked-control training. In the active condition, participants will perform the neurofeedback task, using a visual feedback of an animated fish swimming in the sea, which its movement is be determined by participants’ brain-to-brain coupling in the IFG (Figure 1). In the yoked-control training participants will receive a recording of the feedback from a yoked pair of participants. Depressive symptoms will be assessed again at post-treatment. Based on evidence that deficits in social functioning contribute to the perpetuation of depression (Kupferberg et al., 2016), I predict that training individuals with depression to synchronize their IFG activity with their non-depressed interaction partner could increase their feeling of connectedness and social support and alleviate depressive symptoms.

This series of studies may represent a significant advancement in our understanding of social deficits in depression by addressing the limitations of previous research and providing innovative, reliable, and valid insights into the neural processes involved. The findings of these studies hold vital implications for developing therapeutic approaches to alleviate depressive symptoms with a focus on social interactions.

**Short description of research:**

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**Figure 1:**

**Dyadic Neurofeedback.**

Brain activity is measured simultaneously in pairs, and the feedback on the screen is based on brain-to-brain coupling.

Credit: The Social and Affective Neuroscience Lab-University of Haifa
The twenty-first century has ushered in a new age of information, updating and rekindling anxieties regarding truth and representation. Traditionally, these anxieties found their articulation through the trope of the theatre. The doubled aspect of theatrical representation—its construction of bodies and spaces which are simultaneously real and virtual—served as an example, if not a proof, of the doubled aspect of reality itself. Theater, in turn, has reinforced this connection by producing multi-layered dramaturgies that mirror the intricate and inherently dual structure of the world. The information age, however, is producing a wholly different theatrical convention, one that specifically avoids representation and its split logic. Since the turn of the century, an increasing number of theatre-makers produce lecture-based works which abandon the hallmarks of theatrical production by eschewing action, space, and character altogether. Artists from various fields including dance, visual art, music, and theatre are inclined to present themselves by their real name, to acknowledge the context of the performance, to refer to their present political and historical moment: to undo all traces of doubleness. Most importantly, these new works take on distinctly pedagogical and epistemic tasks, rather than affective or aesthetic ones. By overcoming their own theatricality but committing to an embodied and de-mediatized live event, these artists are mobilizing the theatre not only to articulate a new dramaturgical logic, but to produce an embodied, undoubled epistemology.

My research seeks to understand and articulate more clearly the aesthetic-epistemic position that these twenty-first century works compose, and the challenge that they present to representational thinking. Centering on the convention of the lecture-performance and adjacent forms, I trace the histories of this development and its links to contemporary debates while also theorizing its present aesthetic and philosophical contributions and consequences. These works, which re-conceive knowledge in embodied and event-based terms, offer forceful critiques of Enlightenment epistemologies and alternatives to its logics — positing the age-old medium of theatre as a surprisingly relevant arena for the age of information.
The philosophy of arithmetic topology, first established by Mazur, gives an analogy relating arithmetic to lower dimensional topology. Under this philosophy, one gets a dictionary, relating Number fields and 3-manifolds, primes and knots, and p-adic fields and surfaces.

For example, class field theory for a number field $K$ can be stated as a sort of 3-dimensional Poincare duality in the etale cohomology of $\text{Spec}(\mathbb{O}_K)$.

Looking at etale homotopy groups for prime fields $F_p = \mathbb{Z}/p\mathbb{Z}$ we get: that the etale fundamental group is the profinite completion of $\mathbb{Z}$ and all higher homotopy groups vanish and so we regard $\text{Spec}(F_p)$ as an arithmetic analogue of a circle $S^1$.

Since $\text{Spec}(\mathbb{Z})$ has etale cohomological dimension 3 (up to 2-torsion) and trivial fundamental group, it can be viewed as the 3-sphere. We thus get that the embeddings $\text{Spec}(F_p) \rightarrow \text{Spec}(\mathbb{Z})$ can be viewed as the arithmetic analogue of a knot, i.e. an embedding of the circle in the 3-sphere.

The analogies between knots and primes, 3-manifolds and number rings were later studied more by Kapranov and Reznikov.

In the view of the analogy above, a knot group $G_K = \pi_1(S^3 \setminus K)$ corresponds to a “prime group” $G((p)) = \pi_1 \text{ et } 1 (\text{Spec}(\mathbb{Z}) \setminus \{(p)\})$. More generally, a link $L$ corresponds to a finite set of primes, $S$, and the link group $G_L = \pi_1(S^3 \setminus L)$ corresponds to $G_S = \pi_1 \text{ et } 1 (\text{Spec}(\mathbb{Z}) \setminus S)$, the Galois group of the maximal Galois extension of $\mathbb{Q}$ unramified outside $S \cup \{\infty\}$.

Under this we see that the absolute Galois group of $\mathbb{Q}$ can be seen as the fundamental group of the 3-sphere minus infinitely many knots. Under this, a lot of the local structure is not accounted for. For example, it only looks at the tamely ramified part, and always corresponds a p-adic field to a genus 1 surface. We hope to enrich the existing dictionary to take into account for all the Galois group of a p-adic field, and to associate different genus surfaces, depending on the degree of the extension over $\mathbb{Q}$.

Topological Quantum Field Theory (TQFT) came up in physics as a framework for combining classical field theory with quantum mechanics and general relativity. In this framework one computes certain topological invariants of the theory.

The theory takes a manifold with boundary and returns vector spaces and maps between them. In our work we hope to use the analogies of arithmetic topology mentioned above to define a generalized TQFT which takes values in low dimensional topology and in Number theory at the same time, further strengthening the relation between the two, and providing with potential new invariants for physical theories to be computed.
Knowledge has consistently played a fundamental role in the context of imperial and colonial expansion. The generation of knowledge about the history, language, and culture of colonized subjects empowered European powers, enabling them to assert dominance. Simultaneously, the colonial experience fostered cross-cultural knowledge exchanges that reshaped local and migrant ideas, served as a wellspring of inspiration for intellectuals, and exerted influence on colonial policies. One of the notable cities where such exchanges thrived was Jerusalem during the Mandatory era.

My current research project is an empirical and critical study exploring how transnational encounters in British Mandate Jerusalem (1920–1948) transformed knowledge as part of its interplay with politics and culture. It focuses on the case study of the Palestine Folk Museum, one of the trading zones of knowledge where Jews, Arabs, and the British collaborated in the production of cultural knowledge.

This study’s point of departure is that migrating knowledge is neither static nor unchanging, and while the asymmetry of power relations should always be in mind, constellations of knowledge transfer in the colonial context should not be viewed solely from a narrow European perspective, as is often the case, but rather as what historian Peter Burke referred to as “double deprovincialization,” where existing knowledge and perceptions on all sides change, and new knowledge is generated.

Until recently, scholarship on the history of knowledge in late-Ottoman and Mandatory Palestine tended to focus on a single side of the ‘Palestine triangle’ – be it Jewish, Arab, or British. I, therefore, aim to bring together Jewish, European, and Middle Eastern histories into a multidisciplinary study that will provide a rich and relational analysis of how cultural and political interactions in Mandatory Jerusalem impacted knowledge. Unlike existing studies of colonial cultural-intellectual intersections, which emphasize colonizer-native relationships, the context of Mandate-era Jerusalem surpasses these confines. Its British-Jewish-Arab hierarchies provide an opportunity to reassess the dynamics of knowledge production within a multifaceted web of power dynamics and collaborative efforts.

As a Bloom Postdoctoral Fellow, I will explore the untold story of the Palestine Folk Museum. Founded in 1936, the museum was an Arab-British-Jewish initiative aimed at preserving the local material culture and folklore of fellahin and Bedouins in rapidly modernizing Palestine. Its exhibitions included traditional costumes, domestic and religious utensils, musical instruments, weapons, and farming tools. Remaining open until early 1948, the museum – like other enterprises I plan to delve into as part of this project – served as a point of convergence for three types of knowledge: local knowledge; imperial knowledge; and disciplinary knowledge. Moreover, by combining migrating and local scholarly and national conceptions of folklore and heritage, the foundation of the Palestine Folk Museum constituted a rare cultural collaboration during some of the most violent years of the Arab-Jewish conflict in Mandatory Palestine.

As a cultural and intellectual historian who focuses on transnational encounters and the knowledge that they produce, I will draw on various archives to trace the distinct role of multiple players in establishing the Palestine Folk Museum and the ideologies that motivated them. I will also explore how the Museum and the different types of knowledge it amalgamated, produced, and reproduced were used by different actors to promote their distinct interests. I will address these questions through a focus on three of the museum’s founders – Humphrey Bowman, Tawfik Canaan and L. A. Mayer, each representing one of these types of knowledge.

By examining the museum from their respective points of view, I seek to reveal the three types of knowledge that converged in this undertaking and their entanglements. Having gained vast experience in archival work, I will draw mainly on unpublished archival materials in English, Arabic, German, and Hebrew from Israel and the UK, as well as contemporary newspapers, memoirs, catalogues, and British government official reports. I plan to incorporate the results and the conceptual framework they will help me construct into a book on colonial encounters of knowledge in Mandatory Jerusalem.

By exploring the cultural and political functions of the three types of knowledge – local, imperial, and Orientalist – in the making of the Palestine Folk Museum and other knowledge-producing institutions in Mandatory Jerusalem, my project will not only reveal an untold chapter in the cultural history of Mandate Palestine but will also shed new light on the history of knowledge migration, colonial museums, and learning institutions, and the relations between them. The project, moreover, will enrich the discussion on transnational encounters in twentieth-century imperial settings: both by looking at Mandatory Jerusalem as a case study in its own right and by using it as a vantage point for future comparative studies in the field.
Suicide is the second leading cause of adolescents’ death. Although Problematic Smartphone Use (PSU) links to increased suicidal risk, the determinants of these associations, including temporal dynamics and specific interpersonal and objective circumstances, remain uncertain. To address these gaps, this research focuses on exploring the intricate connections and interactions between PSU, stress factors, and suicidal ideation and behaviors among adolescents. By adopting Joiner’s Interpersonal Theory of Suicide (IPTS), the study emphasizes the importance of examining the role of loneliness as a risk factor. Additionally, the study recognizes the influence of sleep disturbances and cyberbullying on emotional regulation, social functioning, and feelings of loneliness that may lead to suicidal thoughts and behaviors.

The current study aims to investigate the mobile app usage of 100 adolescents aged 11-18 years with recent suicidal thoughts and behaviors who presented to the emergency department. Participants will be recruited from the Depression and Self-Harm Clinic at Schneider Children’s Medical Center of Israel and monitored for six months using the iFeel research app. iFeel is a digital health research platform that provides continuous and objective measurements of phone usage patterns. Specifically for the purpose of this study, the app will be used to obtain objective data on total media and type of media used, app usage (e.g., communication, social, games), and sleep disturbances (measured by sleep onset and duration proxies). Participants will also complete self-report questionnaires on factors related to their mental health, including depression, anxiety, suicidal thoughts and behaviors, subjective use of cellular devices, sleep disturbances, and experiences of cyberbullying. These additional measures will offer further insights into the complex interactions between these factors and participants’ mobile app usage. The data will be analyzed using repeated measures to track changes in the dependent variables over time and assess the impact of the independent variables on these changes. Multilevel models will be employed to address the hierarchical nature of the data, with repeated measures nested within individuals. This approach provides examination of within-person changes over time and between-person variations in the relationships between the independent and dependent variables. Furthermore, multilevel moderation analyses will explore potential moderating effects on the relationships between the variables.

The current research introduces innovative methodological approaches to the research field of suicide. The collection of real-time data, including both subjective and objective measures of smartphone use, provides a more accurate and ecologically valid assessment of participants’ phone use patterns, and a more comprehensive insights into the relationship between the individual’s smartphone use pattern, their mental health and well-being and suicide risk among adolescents. Specifically, the research explores the role of loneliness as a risk factor, and its interactions with PSU and other factors. By examining these associations, the study enhances our understanding of the underlying mechanisms and processes that contribute to suicidal ideation and behaviors among adolescents. Lastly, by identifying the associations between the different variables, the research might provide valuable insights for the development of targeted interventions. Such interventions can focus on addressing loneliness, improving sleep quality, and addressing cyberbullying to mitigate the negative consequences of PSU and reduce the risk of suicidal thoughts and behaviors. The results, built upon real-time data, can also be used to promote self-awareness and regulation of smartphone use.

Our findings have the potential to inform the development of real-time prevention intervention programs by identifying early warning signs that indicate a higher risk of imminent suicide, thereby highlighting the need for immediate and targeted interventions. This breakthrough research has far-reaching implications for suicide prevention efforts and the well-being of adolescents.
Bird migration is a world-wide phenomenon where each spring and fall, billions of birds migrate between breeding and non-breeding regions around the world. Israel is located at the heart of a globally-important migration flyway between Eurasia and Africa, bordering two substantial ecological barriers, the Mediterranean Sea and the Sahara Desert. Consequently, this region is characterized by high diversity and abundance of migrating birds (Schekler et al., 2023). However, reliable quantification of bird migration is difficult as many migrants go undetected, particularly at night (Nilsson et al., 2019). Specifically, in recent years much progress has been made on quantifying the migration bioflow but its composition of species was not addressed.

Bioacoustic monitoring is a non-invasive method with a long detection range, independent of daylight and is highly effective for data collection. Automatic identification and monitoring of bird vocalization during migration, known as flight calls, can be utilized for characterizing and mapping bird migration (Pamula et al., 2019), as it is a useful method for identifying bird species (Cramer et al., 2020), estimating migration timing and density (Van Doren et al., 2023), and can even help in gaining insights into bird behavior during migration (Gayk & Mennill, 2023). Integrating bioacoustics and radar data can potentially improve our ability to detect migratory species and deepen our understanding of animal movement in the airspace as radar data provides information on the location and amount of migrating birds and acoustic measurements can identify bird species (Lostanlen et al., 2019).

My main objective will be to integrate radar and acoustic data for better characterization of bird migration in Israel. In Chapter 1 I will use the computational tools of audio signal processing that I acquired during my M.Sc research (Marck et al., 2022) to analyze bird bioacoustics data from ground level in the Hula Valley in the context of bird migration. I used data collected over the last 4 years from recording devices deployed on several sites in the valley. Using this data, I aim to identify migration peaks, species composition and how they might be shaped by environmental effects. Chapter 2 will include integration of bird bioacoustics and radar data from the Hula Valley to improve our understanding of bird migration. I will use data collected by the BirdScan-Mr1 radar located in the Hula Valley since 2018. I will examine the relationship between the acoustic measurements and the radar data, to explore whether they complement each other. For example, the radar will be able to quantify migration peaks at different altitudes above ground level and the acoustic data will allow reliable identification of low-flying birds. On the next stage I will examine radar data from multiple altitudes to determine if the bioflow characteristics are similar across altitudes in relation to bird body size, speed, flight characteristics (e.g., wing beat frequency). This will allow me to assess whether the low-flying birds are likely representing also higher-flying birds in terms of species composition. In Chapter 3, I will use a more direct approach to address this question by using high altitude acoustic measurements by deploying a 18 m3 helium-filled aerostat that will carry acoustic recorders. These acoustic data will be compared to the radar data to characterize the aerial niche of migrating bird species. The aerostat will be launched to altitudes up to 500 m above ground level (Werber et al., 2023) and will be equipped with recording devices every 100 m. This unprecedented data collection will allow me to identify the composition of bird species at multiple altitudes to address this chapter’s research question which is whether different species have different altitudinal profiles during migration? Overall, these three chapters are expected to substantially contribute to our understanding of bird migration in Israel and will also promote data integration and cross-calibration in the study of bird migration and aeroecology.
When a person performs a task, the attention system can shift from processing the task-related stimuli to internal information such as daydreaming, memories, and worries. This state is often called Interfering Thoughts (e.g., Smallwood et al., 2003). This is a common process and it has been suggested that in adults it occupies approximately 50% of one’s waking time (Killingsworth & Gilbert, 2010). The current study will thoroughly examine the association between interfering thoughts, attention deficiency symptoms, and academic-related task performance in children from kindergarten to their early school years.

Preschool is an important developmental stage in which children begin to acquire the building stones for proper academic abilities. Previous studies in children explored different cognitive structures and abilities that promote proper learning, such as self-direction, persistence, motivation, and attention. However, the association between early interfering thoughts in very young children and the development of attention deficiency symptoms, and task performance impairment has yet to be studied. This is a pioneer study as it is the first to address these important issues directly. This is of upmost importance particularly since, as noted above, interfering thoughts are not an esoteric phenomenon.

The current work will extend my thesis work that was recently submitted for publication (Pasternak-Barami & Goldfarb, submitted). In my thesis work we found for the first time that in kindergarten-aged children, interfering thoughts were related to their attention abilities.

In addition, increased interfering thoughts were related to poorer task performance in kindergarten level tasks. The current PhD study will extend those findings. The study is a longitudinal study in which the same 100 children that we previously sampled in kindergarten will be followed for the next years, from first to fourth grade. This will allow us to examine the influence of interfering thoughts in preschoolers on further performance in various situations. These include attentional difficulties in everyday life and the tendency to develop ADHD symptoms in later years. Recently, the European statement on adults with ADHD has suggested that mind wandering is a common characteristic of adults with ADHD. Among children, the prevalence of ADHD is approximately 5-10% (APA, 2013; Kessler et al., 2005), and it relates to academic impairments as well as other non-academic impairments such as social impairments (e.g., Barkley et al., 2006). Hence, the current line of study is of upmost importance. In addition, the current work will examine the influence of interfering thoughts on further impairment in the performance of school-related tasks. This will include both the development of literacy abilities as well as the development of arithmetic abilities from the first to fourth grade. Studies on interfering thoughts in older participants suggest that they can impair performance on a variety of measures and are related to impairment of performance in tasks (Keulers & Jonkman, 2019; Mrazek et al., 2013; Soemer et al., 2019). Hence, the current study will extend those findings to relevant school-related tasks.

Identifying interfering thoughts as a factor that is related to attention deficiency and poorer task performance in the early years might have an important potential contribution to improving the performance and well-being of the population of children. This might also enable fast and easy mapping for children with a risk of attentional and academic difficulties in early childhood. The preschool years have great importance for understanding and advancing future academic functioning. Identifying interfering thoughts as a factor that is correlated with poorer task performance in the early years might have an important potential contribution to later academic performance and to preventing later negative life experiences from the entrance to elementary school.

Short description of research:

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A major trend in operator theory is the study of product systems, as it serves as a suitable context for examining symmetries and dynamics in noncommutative geometry, besides offering a diverse range of examples.

My planned project aims to explore the subject using two novel methodologies. The first one is the application of non-self-adjoint operator algebras and dilation theory to product systems, particularly the characterization of the C*-algebra via dilation theory of representations. Simultaneously, there’s an active development in incorporating higher category theory into the study of product systems to unify theories of product systems, Fell bundles, Leavitt path algebras, and groupoid models. I am going to contribute to both of these directions with the aim of unifying them. Ideal structure. The Cuntz-Nica-Pimsner algebra’s gauge-invariant ideal structure is an essential invariant in product systems. This invariant aids in distinguishing product systems with non-Morita equivalent CNP-algebras, a topic of interest in shift equivalence theory and other branches of operator theory. Sims used this structure in higher-rank graph algebras to describe graph algebra quotients with respect to subgraphs as relative graph algebras. A description of gauge-invariant ideals can be used to extend his result to a general context of product systems, and reveal new properties of non-commutative dynamics that are worthy of study. In an influential paper of Katsura, he classifies gauge-invariant ideals in the Cuntz-Pimsner algebra of a single correspondence. This work later inspired Dor-On and Kakariadis to establish gauge-invariant uniqueness theorems. In my Master’s thesis, I was later able to use Dor-On and Kakariadis’s ideas to describe the gauge-invariant ideal lattice of the Cuntz-Nica-Pimsner algebra of a proper product system was described in my master thesis.

Our goal is to extend this result in two directions. Firstly, we would like to replace properness of a product system with a weaker assumption, which still allows us to describe the ideal lattice. A good candidate for this kind of property is the strong compact alignment. Another direction is a classification of ideals in product systems over more general semigroups.

Dilation theory for product systems
It was shown, in increasing levels of generality, that the Cuntz-Nica-Pimsner algebra of a product system over a subsemigroup of a group is isomorphic to the C*-envelope of the tensor algebra of the product system. In its turn, the C*-envelope is universal with respect to maximal representations, that is, representations which have no non-trivial dilations. We are going to study dilation theory for product systems. Our starting goal is to fully describe maximal representations in case of a single correspondence and then try to extend it to more general product systems.

We will try to generalize previous results of several authors concerning special cases. Katsoulis and Kribs proved that all maximal representations are covariant, inferring that the Cuntz-Pimsner algebra envelopes the tensor algebra. Kim showed that all covariant representations are maximal if the Katsura’s ideal acts non-degenerately on the correspondence. Dor-On and Salomon determined maximal representations for graphs. Completing our goal of classifying all maximal representations will lead to informed proofs of all these results, and enlighten how to move forward in the higher-rank case.

Bicategories. A promising attempt to integrate higher category theory to product systems was initiated by my master thesis supervisor Ralf Meyer. We are going to add non-self-adjoint algebras to this picture by adding them as objects to the bicategory. We also plan to interpret compatible shift equivalence of matrices defined in terms of the bicategory of groupoid correspondences.

Short description of research:
A major trend in operator theory is the study of product systems, as it serves as a suitable context for examining symmetries and dynamics in noncommutative geometry, besides offering a diverse range of examples.

My planned project aims to explore the subject using two novel methodologies. The first one is the application of non-self-adjoint operator algebras and dilation theory to product systems, particularly the characterization of the C*-algebra via dilation theory of representations. Simultaneously, there’s an active development in incorporating higher category theory into the study of product systems to unify theories of product systems, Fell bundles, Leavitt path algebras, and groupoid models. I am going to contribute to both of these directions with the aim of unifying them. Ideal structure. The Cuntz-Nica-Pimsner algebra’s gauge-invariant ideal structure is an essential invariant in product systems. This invariant aids in distinguishing product systems with non-Morita equivalent CNP-algebras, a topic of interest in shift equivalence theory and other branches of operator theory. Sims used this structure in higher-rank graph algebras to describe graph algebra quotients with respect to subgraphs as relative graph algebras. A description of gauge-invariant ideals can be used to extend his result to a general context of product systems, and reveal new properties of non-commutative dynamics that are worthy of study. In an influential paper of Katsura, he classifies gauge-invariant ideals in the Cuntz-Pimsner algebra of a single correspondence. This work later inspired Dor-On and Kakariadis to establish gauge-invariant uniqueness theorems. In my Master’s thesis, I was later able to use Dor-On and Kakariadis’s ideas to describe the gauge-invariant ideal lattice of the Cuntz-Nica-Pimsner algebra of a proper product system was described in my master thesis.

Our goal is to extend this result in two directions. Firstly, we would like to replace properness of a product system with a weaker assumption, which still allows us to describe the ideal lattice. A good candidate for this kind of property is the strong compact alignment. Another direction is a classification of ideals in product systems over more general semigroups.

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Bicategories. A promising attempt to integrate higher category theory to product systems was initiated by my master thesis supervisor Ralf Meyer. We are going to add non-self-adjoint algebras to this picture by adding them as objects to the bicategory. We also plan to interpret compatible shift equivalence of matrices defined in terms of the bicategory of groupoid correspondences.
This study addresses the urgent need to better understand interactions between gelatinous zooplankton and their environment – the marine ecosystem of the Southeastern Mediterranean Sea (SEMS). The objective of this research is to examine gelatinous zooplankton (with emphasis on ctenophores and scyphomedusae) in the ultraoligotrophic waters of the Southeastern Mediterranean Sea, with a focus on their population dynamics and polyp distribution.

The main research directions include monitoring the population dynamics of gelatinous zooplankton, localization of scyphozoan polyps, and revealing the effects of climate change and the parasite pressures on diversity and abundance of gelatinous zooplankton in the SEMS. Elaborating these interrelated directions will be the key to solving the problem of understanding interactions between gelatinous zooplankton and the ecosystem of the SEMS.

Estimating the abundance of gelatinous zooplankton is challenging since their distribution is often very heterogeneous, both in the horizontal and vertical dimensions and this requires innovative solutions. This research aims to describe the spatiotemporal changes in gelatinous zooplankton abundance and diversity, providing insights into their ecological dynamics and the impact of environmental factors on their distribution. To accomplish the aim, it is planned to employ multiple approaches. I will explore the option of using a combination of approaches to detect the abundance of gelatinous zooplankton, such as net sampling, underwater and in-situ imaging, using other animals, which feed on jellyfish and ctenophores, as “samplers” whose guts and feces can be studied, and statistical analysis and environmental modeling. This technology, on the one hand, will allow a more complete assessment of the abundance and on the other enables the data collection in a non-destructive manner.

In most scyphozoan species worldwide, including the species of the Israeli Mediterranean, the location of polyps is unknown. By studying the distribution of jellyfish polyps, we aim to identify their preferred benthic habitats. The establishment of the full life cycle of scyphozoans is critical for the understanding of bloom dynamics. To find out where the jellyfish polyps are located, I plan to carry out diving and use a Remotely Operated Underwater Vehicle (ROV) for the installation of Autonomous Reef Monitoring Structures (ARMS) to examine planulae settlement on a variety of substrates, combined with DNA metabarcoding and microscopic methodologies.

Climate plays a pivotal role in shaping the dynamics of gelatinous zooplankton populations in marine ecosystems, affecting development, abundances, and distribution. Temperature is a key factor affecting the reproductive processes of scyphozoans and ctenophores, whereas parasites are important ecological players in regulating host populations, and their presence can affect marine ecosystem dynamics. Together the combination of warming and parasitism might play a crucial role in the survival of marine organisms. Examining the adaptations and responses of jellyfish and ctenophores to the changing environmental conditions in the oligotrophic Levantine Basin will shed light on their population dynamics and ecological interactions with parasites. Investigating the ‘gelatinous zooplankton – parasites’ interaction in light of climate change requires field studies and an experimental approach. Field studies will be conducted to investigate the distribution of parasites among gelatinous zooplankton and their interactions. Parasites will be studied using morphological and DNA taxonomic analyses. I plan to use an experimental mesocosm to test the effect of warming on the survival and performance of infected and non-infected gelatinous zooplankton hosts under controlled conditions.

Understanding gelatinous zooplankton population trends and bloom factors can help manage future jellyfish and ctenophores outbreaks and invasions, benefiting coastal communities, fisheries, and tourism sectors and preventing damage both to the ecosystems and economics. Moreover, insights into future climate change effects and ‘gelatinous zooplankton – parasites’ interaction will inform future conservation and adaptation strategies, supporting marine biodiversity and ecosystem resilience.
Ancient philosophy and contemporary neuroscience support the notion that the self is a malleable mental construct influencing perception and action. Accumulating evidence shows that this self-construct can be ‘loosened’ or even dissolved in altered states of consciousness (ASCs) induced by meditation and psychedelics (Millière et al., 2018). However, the neural correlates of these states and their long-term effect on well-being is still unknown. Meditation-induced states of relaxed self-boundaries have been associated with beneficial experiences such as relaxation, happiness, and connectedness to the world (Dambrun & Ricard, 2011). This proposal aims to deepen our understanding of these states and develop a safe, scalable neurofeedback-assisted meditation intervention to promote well-being. The proposed PhD is part of a larger pre-registered project (Berkovich-Ohana et. al, 2023).

Our research is grounded within the theoretical framework of predictive processing (PP, Hohwy & Seth, 2020), which interprets brain dynamics as a product of the interplay between predictions about incoming sensory signals (priors) and prediction errors, designed to minimize these errors. Changes in self-experience are hypothesized to stem from relaxed high-order priors and changes in the expected precision-weighting of self-evidence in both meditation (Laukkonen & Slagter, 2021) and psychedelic intake (Carhart-Harris & Friston, 2019). Studies have associated meditation-induced self-dissolution with reduced beta-power in the posterior-cingulate-cortex (Dor-Ziderman et al., 2016). For psychedelics, an increase in the entropy of neural activity, as estimated by Lempel-Ziv complexity (LZc) in the default-mode-network (DMN), a well-established self-processing network, and a reduction in transfer-entropy (TE) between nodes of the DMN have been observed (Mediano et al., 2020).

Correspondingly, our hypotheses are: (H1a) Compared to control states, meditation and psychedelic-induced self-dissolution states show enhanced DMN LZc, altered DMN TE and reduced PCC beta-power; (H1b) H1a measures correlate positively with phenomenological indices of self-dissolution (interviews/5D-ASC scales), and rated experiential intensity; (H2) Participants succeed in regulating state-derived measures using neurofeedback; (H3) Up-regulation corresponds with experienced meditative depth and with short and long-term wellbeing.

We will study neural correlates of self-dissolution using existing data from proficient meditators (n=46), LSD (n=17), and Psilocybin (n=14) groups. We will calculate LZc in the DMN, TE between DMN nodes, and PCC beta-band power to confirm our hypotheses, and explore other brain regions for broader neurofeedback indices. These measures will be validated on a Psilocybin EEG dataset (n=28) and correlated with self-reports and a phenomenology-based dissolution-index. Neural indices showing largest correlation with phenomenology will utilized in the neurofeedback intervention.

For the neurofeedback intervention, we will conduct a 4-week intervention, in which meditation-naïve participants undergo a 10-day meditation pre-training, followed by 4 EEG-neurofeedback sessions. We shall conduct a double-blind randomized-controlled study with treatment and active-control groups (n=20 each). Outcomes will be measured pre- and post-intervention via neural indices, self-reports and phenomenological interviews, and at 1- and 6-months follow-up via mental health and well-being questionnaires and post-intervention self-reported meditation practice. Training effects will be assessed via interaction of within (timepoint) and between (group) factors. Post-treatment and follow-up effects will be discerned by evaluating the respective interaction contrasts with reported post-intervention practice serving as covariate.
Autism spectrum disorder (ASD) is a spectrum of complex neurodevelopmental disorders that affect communication, social interaction, and behavior. As the prevalence of ASD continues to rise, the development of effective and scientifically-based interventions becomes increasingly important for improving outcomes and quality of life for individuals with ASD, and the well-being of them and their families.

Studies of brain connectivity suggest that abnormal neural network organization may underlie ASD-related symptoms. Findings point not only to atypical functional connectivity involving many cortical regions of individuals with ASD but also to diminished brain-to-brain connectivity relative to typically developing individuals. Inter-brain connectivity is thought to be fundamental to Interaction-based learning, i.e. the acquisition of knowledge or skill through social interactions. Thus, the abnormal intra- and inter-brain connectivity in ASD may account for the deficits in their socially-based learning and subsequent mutual social alignment.

In recent years, there has been an increased interest in neurofeedback-based interventions for ASD and other disorders, due to their lack of observed side effects, their playful and thus engaging nature as well as their long-term beneficial effects. Here, we aim to examine whether the brain-to-brain coupling of individuals with ASD may be trained using neurofeedback.

The objective of my PhD study is to develop and validate a novel functional near-infrared spectroscopy (fNIRS; A non-invasive and compact brain-imaging technique based on blood oxygenation measures) dyadic neurofeedback platform to train participants with autism to enhance their brain-to-brain coupling, which we hypothesize to contribute to enhancing their social interaction-based learning. The validation of the platform will be conducted via a randomized controlled trial involving participants with ASD. Subsequently, I will estimate its beneficial effects on other aspects related to ASD day-to-day function and experience.

This study has potentially significant implications for the field of ASD research, as it provides a novel approach to enhancing social interaction skills in individuals with autism. Furthermore, following validation, the developed platform can be adapted for use in other populations with similar social communication deficits.
Our research aims to develop general non and semi parametric methods for estimating geometrical objects (curves and surfaces) in high dimensional spaces from noisy data under very general data generation processes. The main assumption of the proposed statistical models is the existence of some unobservable (latent) variables belonging to the curve or surface, where the observed data assumed to be a noisy version of those latent variables.

The research belongs to the area of manifold learning and nonlinear dimensionality reduction which nowadays is an active topic in unsupervised learning. The need to identify such geometrical objects arises in a wide variety of applications, such as computer vision, geography, medical imaging, astronomy and many more.

These days, most of the available methods are lacking in statistical theory and properties. Thus, we intend to derive not only general estimation schemes, but also statistical properties of our proposed estimators. Properties such as consistency, rate of convergence, asymptotic distribution and semi – parametric efficiency.

In addition, due to the general assumptions regarding the data generation process we aim to derive estimators which possess ‘good’ statistical properties under wide conditions and settings. Moreover, since estimation problems such as described above, are basically optimization problems that require the use of numerical algorithms and minimization of functions which are not necessarily convex, additional part of our research deals with the development of general and numerically stable estimation procedures which are able to overcome the difficulties of non – convexity.

For example, our last research dealt with circle fitting to noisy data, where the assumed statistical model enabled us to obtain consistent maximum likelihood estimators of the circle parameters (center and radius), even if the data is concentrated across a small circular arc. In addition, we showed superiority of our estimator compared to other general circle fitting procedures, under a wide range of data generation processes.

Figure 1: Realizations of 2 common circle fitting methods; algebraic (red dotted line) and geometric (blue dashed line) fits along with our proposed MLE (magenta dotted line)

Does exposure to terrorism prompt support for pacifying or escalatory state counter-terror policies? What is the role of public trust and emotional distress in this relationship? Amit Cohen is part of a broader team of researchers at Professor Daphna Canetti’s Political Psychology Lab at the University of Haifa, where examining the complex interplay between psychological challenges and policy implications of conventional terror and cyberterror takes center stage.

In anticipation of peaceful conflict resolution, the backdrop for Amit’s investigation is the harrowing 7/10 terror attacks on Israel, a stark reminder of the formidable challenges facing democratic societies in their aim to end political violence that targets civilians. Beyond the immediate loss of innocent lives, these acts of terror inflict profound emotional distress on the public writ large. Amit’s research emphasizes the often-overlooked consequence in the political conflict literature – the potential translation of this emotional distress into support for non-democratic processes. This sets the stage for a constant tension between the imperative of maintaining personal security and the parallel need to uphold democratic values.

Amit’s research is firmly grounded in established scholarship, and its core hypothesis posits a consequential relationship: exposure to terror leads to emotional distress, which, in turn, influences public support for either more stringent counter-terrorism policies or pacifying alternatives. Another facet of the study explores the role of public trust in government as a crucial variable. It postulates that individuals with heightened trust in government institutions will respond differently to counter-terror policies, whether leaning towards dovish or hawkish approaches.

To unravel these complexities, Amit plans to employ cutting-edge Virtual Reality (VR) technology both within and outside the lab. This innovative approach aims to measure the extent of exposure to terror and its psycho-political impact on civilians. VR provides a nuanced and immersive understanding of the emotional toll inflicted by acts of terrorism, allowing for a more comprehensive analysis of its influence on public sentiment. Subsequent experiments will explore how individuals, based on their exposure and emotional response, lean towards either hawkish or dovish counter-terror policies.

The geographical focus of the initial phase of this research is Israel, where the effects of terrorism are acutely felt. However, Amit’s ambition extends beyond these borders, with plans for subsequent studies in the United States and the United Kingdom. By broadening the scope, the research aims to capture diverse perspectives and experiences, enriching the understanding of the global implications of terrorism on political attitudes and policy preferences.

As Amit’s research marks its one-year milestone, it is a testament to the ongoing commitment to unravelling the intricate dynamics that link terrorism, emotional distress and state counter-terror policies. The innovative use of Virtual Reality underscores the dedication to advancing ground-breaking methodologies, ensuring a nuanced comprehension of the psychological and political repercussions of terrorism on democratic societies. As innocent lives are caught up in the proliferation of political violence around the world, the importance of Amit’s research is to develop and test theoretical models, as these will aid both predictive capacity and the potential for state intervention. Of course, no intervention will be as momentous as peace, but Amit’s ever-relevant study indicates how psychologists may both limit psychological distress and many of the underlying attitudes that contribute to the continued cycle of hatred, aggression and violence against civilians.

**Short description of research:**

During experimentation using Virtual Reality (during Covid-19)

Political Psychology Lab researchers

Researching the psycho-political effects of cyberterror
Human life expectancy has witnessed worldwide growth; the population has become older and is expected to grow even more. Population over the age of 60 is predicted to increase up to two billion people (21% of the population) by 2050. Therefore, there is a great need to support healthy aging and wellbeing. Aging eventually leads to sensory impairments such as age-related hearing loss (ARHL), which is one of the most common sensory deficits. ARHL is known to accelerate cognitive decline and increase social isolation. Therefore, it is important to develop methods to address the health need of this growing population and minimize the age-related sensory decline.

Age-related sensory declines are unavoidable and impact older adults’ performance of everyday tasks including conversations with friends. Most critically, aging affects the perception of speech, especially in noisy environments. Healthy aging leads to decrements in auditory perception, even without clinical diagnosis of hearing loss. Although research has demonstrated that sensory decline is a natural part of aging, very few recovery protocols are available. Previous studies have shown that sensory restoration by using hearing aids can improve audibility, cortical and cognitive function in adults with ARHL. However, how these might affect cortical and cognitive function in normal-hearing older adults has not been investigated yet.

Therefore, in the current proposal we aim to examine whether the use of hearing aids can improve cognitive and speech in noise perception in normal-hearing adults. Moreover, we aim to investigate the neurophysiological changes in auditory function through the use of hearing aids using electrophysiological measures. These convergent methodologies, will help us understand the neural-cognitive-perception association in the aging brain, before a significant sensory decline takes place.

To pursue the research aims, sixty normal-hearing adults (50-70 y/o) will be recruited for the study and divided into two groups (hearing aid fitted group, and a control non-users group) that undergo identical sessions over a period of six months. Measures will include: Audiological, speech perception and cognitive tasks, and electrophysiological brainstem and cortical auditory evoked recordings.

If outcomes are favorable, recovery protocols for hearing difficulties among older adults should be reconsidered. In other words, pure tone threshold audiograms would not then be the sole determine factor for receiving treatment strategies. As being a clinician, I see this phenomenon frequently and I have nothing to say, until a hearing loss is observed. However, through this proposed project we can apply recovery protocols that could improve older adults’ communication and social life and by that improve their wellbeing. In the long term, and on the theoretical part, we hypothesize that this could delay the sensory age-related hearing decline and by that, delaying the cognitive decline that might come with aging. This project will enable better understanding of the perceptual-cognitive-neural model in the aging brain.

Feasibility: My supervisor’s lab will provide the hearing aids, EEG equipment and cognitive toolbox. I do not anticipate a problem in participants’ recruitment, as we have a large pool of participants. All procedures will be ethically approved before initiation.
This research delves into the profound exploration of free will and moral responsibility within the legal systems of Scandinavian countries, focusing on agency models in contemporary philosophy. By critically examining and contrasting diverse agency perspectives in Sweden and Norway, the study aims to advance philosophical discourse on the complexities of moral judgments and responsibility. The innovative "differential model of agency" is proposed, challenging traditional binary notions, advocating inclusivity, and fostering a more just approach to moral assessments. Through rigorous philosophical analysis, this research contributes to a deeper understanding of agency, free will, and their implications for moral reasoning.

Scandinavia presents a constructive case study for the contemporary free will debate, particularly in its treatment of the term 'accountability.' As of 1965, Sweden neglected the accountability aspect in the judicial system, thus neglecting consideration of the criminal’s free will, while Norway did not. Given the cultural and penal system similarities between the two countries, a comparison proves highly instructive.

This study's centerpiece is the groundbreaking "differential model of agency," offering philosophers a transformative approach to understanding moral responsibility. By challenging the traditional dichotomous concept of agency that excludes certain populations, this model resonates strongly with disability studies and advocates for a more inclusive and just perspective on moral agency.

Through careful consideration of an individual's circumstances and motives, the differential model seeks to understand the agency of all people. This profound shift in perspective ensures that each individual's unique experiences and motivations are taken into account. The model's integration with disability studies adds further depth to the research, aligning it with the social justice approach that views disabilities as a form of oppression.

Philosophers can find this innovative model particularly compelling as it not only challenges existing views on free will and moral responsibility but also presents a practical and inclusive solution to address moral responsibility and injustices. A key breakthrough of this study is its focus on human rights and the treatment of marginalized populations based on their neurological diversity or mental health issues. It highlights a troubling loss of respect for persons in the moral judgment process, particularly affecting neurodivergent individuals who face deontologically wrong treatment and denial of autonomy. The study addresses a critical deficiency in examining moral responsibility from marginalized perspectives. One might even say that this study aims to correct a philosophical injustice, created by a theory that justified wrong and discriminatory moral assessment.

In conclusion, this study not only profoundly impacts philosophical approaches to the free will problem but also significantly advances the broader field of free will studies. The "differential model of agency" offers a groundbreaking and inclusive perspective on moral responsibility, inspired by disability studies. Its emphasis on human rights and the fair treatment of marginalized populations based on neurological diversity or mental health issues further enriches the study's contributions. By shedding light on real-world injustices and advocating for a more just society, this research not only shapes the philosophical discourse but also contributes to the evolution of free will scholarship, inspiring a more compassionate and equitable approach to moral judgments while reshaping the fundamental paradigms of free will theory.
Earthquake is a primary geological hazard. Higher magnitude anthropogenic seismicity is associated with an impoundment of reservoirs and their water level fluctuations, termed Reservoir Induced Seismicity (RIS). RIS depends on a complex interaction of the water body with various tectonic, geological and hydrological factors, and is recorded even in tectonically aseismic regions all over the world. Sometimes, RIS is triggered immediately after the water level changes, characterised by low magnitudes. In other cases, the seismic response is delayed, being characterised by larger-magnitude deeper events. RIS patterns differ from those of tectonic earthquakes: their aftershocks continue for a longer time, whereas the ratio of the largest aftershock to the mainshock magnitude is higher. Thus, many features associated with RIS patterns and controls, are unclear today, to be investigated in the research.

Gained theoretical knowledge will be applied to investigate two real cases of the RIS, in the research: the Wenchuan earthquake in China, and seismicity in Lake Kinneret, Israel. The deadly 2008 Mmax7.9 Wenchuan earthquake occurred on the central segment of the Longmenshan fault zone. Its epicenter was near to a large Zipingpu water reservoir, which initial impoundment commenced in September 2005 and the water level rose by 115 m in October 2006. In Israel, 2013 (Mmax3.7), and 2018 (Mmax4.6) seismic sequences with focal mechanisms differing from the tectonic earthquakes controlled by the strike-slip motion at the Dead Sea fault (Fig. 1), are suggested in the research to be also triggered by significant lake level fluctuations. Despite the contemporary high-resolution real-time seismic and water levels monitoring conducted worldwide, and their statistical analysis, a comprehensive understanding of RIS is still missing, which motivates its investigation by physics-based earthquake numerical modelling, to be designed in the research.

A 3D poro-elasto-visco-plastic deterministic model with rate- and-state dependent friction coefficient will be formulated. Poroelastic component will include two-way coupling between solid deformation (momentum) and fluid flow (continuity) equations. This coupling is essential to capture a fluid flow pattern affected by dynamic water loading and to quantify its effect on rock deformation. Faults will be generated in the model, presenting zones of localized elasto-plastic deformations where co-seismic slip and most inter-seismic deformations will localise, coupled to a transient fluid flow in the developed and interconnected dilatant fractures. An importance of the dilatancy is that even a small inelastic volume increase leads to a significant rise in permeability. Moreover, dilatancy produces a plastic strain-softening (used, for instance, for the generation of the initial faults, as in geodynamic models. The seismic cycle will be modeled by a dynamic seismic rupture process attributed to a rate-and-state dependent friction coefficient, to spontaneously generate a series of fast frictional instabilities with an Omori-type aftershock decay.

The model will be designed in a finite elements-based COMSOL Multiphysics simulation environment. It uses adaptive time stepping capable to resolve a long time-scale of the preliminary tectonic deformations and faulting (~millions of years), shorter time-scales of water level fluctuations, and of pore pressure diffusion (~days to years), and the shortest time scale of a co-seismic slip (~seconds to minutes). Various meshes (e.g., flexible randomly oriented 3D tetrahedral mesh elements and others) are available, along with variable meshing strategies with different mesh sizes, defect resolutions and mesh growth rates, at various parts and elements of the modelling geometry. A reliable transient solver is designed for solving highly nonlinear and coupled equations, verified and used in other projects of the Computational Physics Lab.

The research will allow identifying the controls on RIS and its triggering mechanism and will permit to sharpening of the theory of RIS: to assess its key processes and the coupling between them. It is essential for understanding the differences of RIS from the tectonic earthquake sequences and it is especially important for studying the deadly Wenchuan earthquake in China and recent earthquake sequences at Lake Kinneret, Israel, and their connection to the regional water level changes.

Credit: Pixabay