Proceedings of the Conference on Ætiological Approaches of Mental Health Conditions

Network Analysis and Relational Frame Theory

by

Ulster University School of Psychology

The Proceedings contain the records and the Book of Abstracts of the conference held on Friday, the 2nd of June, 2023, at Ulster University, Coleraine Campus, as organised by

Rodrigo Vianna de Almeida
&
Keelan Hall

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Friday, the 2nd of June, 2023

Proceedings of the Conference on Ætiological Approaches of Mental Health Conditions: Network Analysis and Relational Frame Theory

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Ulster University School of Psychology

A hybrid remote and face-to-face Conference held at
H215, Ulster University, Cromore Rd., Coleraine, BT52 1SA
on
Friday, the 2nd of June, 2023

With the participation of

Dr. Eoin McElroy, Speaker

Dr. Jordan Belisle, Speaker

Dr. Miguel Rodríguez-Valverde, Speaker

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Preamble

Three speakers participated in the Conference in accordance with the timetable shown in Table 1. The records of these talks are presented in chapter 1. We received a total of eight poster abstracts, which are presented in the Book of Abstracts (p. 2). In the following paragraphs, we present each speaker.

TIME	SPEAKER	TITLE
9:30am to 11:00am	Dr Miguel Rodríguez Valverde (Universidad de Jaén)	Relational Frame Theory and Psychopathology
11:30am to 1:00pm	Dr Eoin McElroy (Ulster University)	In search of disorders: a network approach to mental ill-health
2:00pm to 3:30pm	Dr Jordan Belisle (Missouri State University)	Relational Density Theory: Meaning and Essence
3:30pm to 4:30	All speakers	Questions and Panel Discussion

Table 1: Timetable of talks.

Dr Miguel Rodríguez-Valverde is an associate professor in the Psychology Department at the University of Jaén (Spain). He is interested in the experimental analysis of language and cognition from a functional-contextual perspective, and its implications for psychopathology and psychological treatment. He completed his PhD at the University of Almería (Spain) with work on an RFT-based analysis of fear conditioning and avoidance learning using psychophysiological measures and behavioural tasks. His postdoctoral work on this topic at the University of Jaén was funded by the Spanish National Research Plan. He has also conducted work on experimental analogues of verbal processes involved in Acceptance and Commitment Therapy, and more recently on the use of reaction-time based tasks for the analysis of derived relational responding.

Dr Eoin McElroy is a lecturer in the School of Psychology at

Ulster University. He is broadly interested in the measurement and epidemiology of mental health problems in young people. Much of his work has involved the analysis of longitudinal cohort studies. After completing his PhD at Ulster, Eoin held postdoctoral positions at the University of Liverpool and University College London, and a lectureship at the University of Leicester. Eoin's work has been funded by the ESRC, MRC, and he is currently leading a project funded by the Wellcome Trust, which is using AI to help integrate mental health data from around the world.

Dr Jordan Belisle is an Associate Professor at Missouri State University in the Behavior Analysis and Therapy Masters Program and Psychology Doctorate program. As an early career researcher, Jordan has published over 100 peer-reviewed journal articles and book chapters. He is the co-author of 2 books, *Research Methods for Practicing Behavior Analysts* and *Acceptance and Commitment Therapy for Behavior Analysts*. Dr Belisle and his students develop, and continue to develop HUB Research and Practice Lab, which stands for Humans Understanding Behavior. Their research ranges in topics form relational training to support neurodivergent learners and Acceptance and Commitment Therapy across populations, to issues of social justice and climate justice. In the lab, they have been developing Relational Density Theory as a quantitative and theoretical extension of Relational Frame Theory to account for complex, higher-order relational responding. Dr Belisle will review that research towards understanding the fuzzy concepts of meaning and essence, as they relate to challenges of mental health in our world today. This work is approached through a contextual and pragmatic lens and builds on the considerable work of past and present scientists in the growing study of relational framing and the relational field.

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List of Acronyms

ABA	Applied Behaviour Analysis
MDS	Multidimensional Scaling
MET	Multiple Exemplar Training
MTS	Match-to-Sample
PCA	PEAK Comprehensive Assessment
PEAK	Promoting the Emergence of Advanced Knowledge
RDT	Relational Density Theory
RFT	Relational Frame Theory
SPOP	Stimulus Pairing Observation Procedure

1. Records of speeches

INTRODUCTION BY RODRIGO.

I might just explain why I used that letter (i.e., Æ). If you look at the usage, it's always been less frequent (Figure 1.1). From just a quick search on Google scholar and then a quick search on word usage from Google N-gram, you can see that "ætiology" with the "Æ" has always been less frequent than any other one, so there is actually absolutely no reason why I chose that, I just like it.

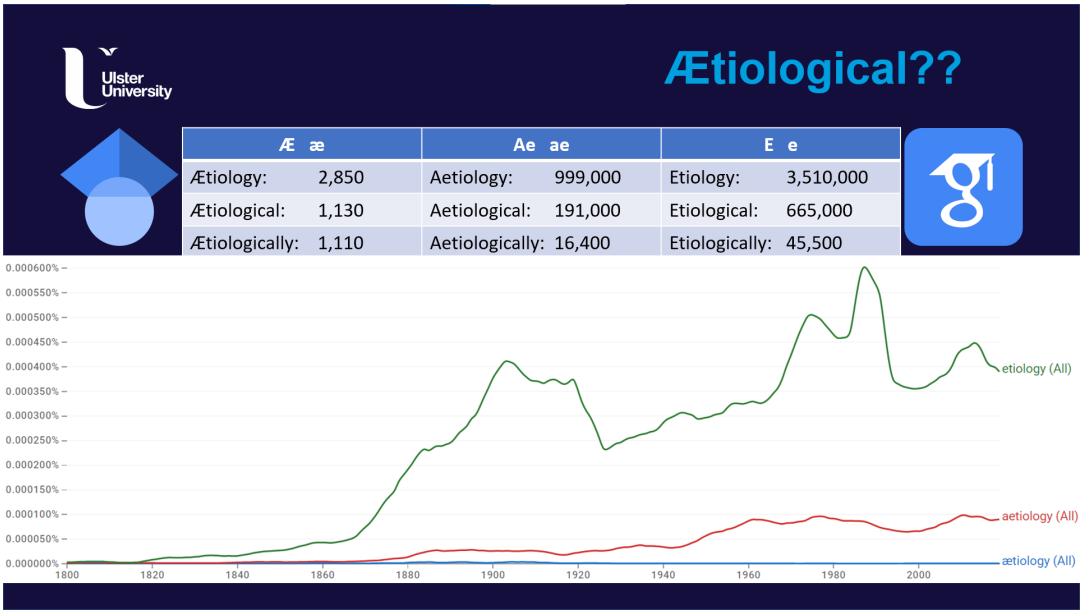

Figure 1.1: Publications with the words "ætiology", "aetiology", and "etiology".

Network analysis and relational frame theory (RFT): why am I bringing together these two things that seem to have absolutely nothing in common? Well, they just create some graphs that kind of look like each other, but their meaning and the reasons behind these connections really don't have anything to do with each other, they mean completely different things.

RFT: Relational Frame Theory

So in terms of RFT anything can be related to anything, right?

You can always find a relation and relate things. So how is a banana related to Venus? They're made of matter or whatever, and they are different in all other possible aspects. But there's always some way to relate things. And I think the way to relate things, when we are bringing together network analysis and RFT, is because they are two different approaches of ætiology, at least from my point of view. I think these two things can actually help us understand the causes of psychological suffering. And so that's how I see the relation between these two things.

Now we are going to have our first talk right now with Miguel, who is right next to me. So Miguel is an associate professor in the psychology department at the University of Jaén. He obtained his PhD the from the University of Almería. He has done a lot of RFT-based analysis about fear, conditioning, and avoidance learning, using psychophysiological measures and behavioural tasks, which is something very important for my current PhD actually. He worked on experimental analogues of verbal processes involved in acceptance and commitment therapy (ACT), and he's interested in the experimental analysis of language and cognition from a functional-contextual perspective and its implications for psychopathology.

ACT: Acceptance and Commitment Therapy

We are now receiving Eoin, who is going to be the next speaker. Eoin is going to talk after Miguel. His a lecturer here in the School of Psychology of Ulster University. He held postdoctoral positions in the University of Liverpool and University College London, and a lectureship in the University of Leicester. I hope I'm saying this right. I'm more concerned about saying Leicester than Jaén, but anyway. He is interested in the measurement of epidemiology of mental health problems in young people. He worked on analysis of longitudinal cohort studies and is currently leading the project, funded by the Wellcome Trust, using artificial intelligence to help integrate mental health data from around the world.

Then we're going to have a poster session and then Jordan's gonna talk. He's gonna be the last speaker. He's an associate professor at Missouri State University. He obtained his PhD

by Southern Illinois University in 2018. So he's an early career researcher; even though he's an early career researcher, he has managed to publish over 100 peer-reviewed articles and book chapters. I don't know how he managed to do that. Impressive, indeed. He co-authored 2 books: *research methods for practising behaviour analysts* and *acceptance commitment therapy for behaviour analysts*. He leads the HUB research and practise lab (Humans understanding behaviour). He and his lab developed relational density theory (RDT) as an extension of relational frame theory using quantitative metaphors from physics to explain complex linguistic and cognitive behaviour.

RDT: Relational Density Thepory

Posters: so we are not going to do a posters-on-display kind of thing at lunch break just because all posters are online. The posters are going to be from 1:00 PM to 2:00 PM, our time, British summer time. Each speaker has about 5 minutes to speak, but you can use a little bit more because we have about 7 presentations, so we have enough time for an hour.

Right, so let's get started with Miguel. I'm going to stop sharing my screen and now, hopefully, we are gonna see Miguel's content.

1.1 Dr Rodríguez-Valverde, "Relational Frame Theory and Psychopathology"

—**Miguel:** So, well, the first thing is thank you very much for the invitation to speak here. I feel really honoured. It's great to be in Ireland and it's it's really great to have the opportunity to speak about RFT on psychopathology. I'd explicitly like to acknowledge my appreciation to the School of Psychology and to Dermot Barnes-Holmes and Rodrigo Vianna de Almeida, who organised this meeting.

[—**Rodrigo**: Thank you for coming.]

—**Miguel:** So the I will be talking about relational frame theory and psychopathology. I'll try to cover RFT from it's introductory aspects to a little more advanced topics, and I will

try to link all of it to psychopathology. So first of all, what is RFT? Relational Frame Theory is a behaviour-analytic account of human language, and cognition, and, more broadly, of complex human behaviour. And a core idea in RFT is that language, defined as derived relational responding, has endowed humans with a unique capacity for suffering, and it sounds like a terrible prospect, but just like language has endowed us with the capacity for problem solving beyond anything. I mean, humans are very good at problem solving all sorts of stuff. And that's why we have, let's say, conquered all sorts of ecological niches. We also have a very unique capacity for suffering and this is a an idea that is shared with acceptance and commitment therapy, which is historically, conceptually and empirically linked to relational frame theory, So, we could say that even when we have everything to be happy, it's likely that we will find reasons to feel miserable or feel unhappy, even when we acknowledge that those reasons are irrational.

So the history behind RFT is long and it includes many things from, I would say, problems with Skinner's original approach to verbal behaviour, the very concept of rule-governed behaviour, and how human behaviour seems to be controlled, at least in some contexts, more by rules and instructions than shaped by direct contingencies. The fact that human operant behaviour, in certain intermittent reinforcement schedules, seems not to be very sensitive to changes in contingencies, not like non-human behaviour, but I think by far the most important milestone would be the discovery of stimulus equivalence by Murray Sidman, which I guess many of you are familiar with. He was working with an individual with a severe developmental delay in trying to teach the individual how to read, basically. He was training relations– um, conditional discriminations. So in the presence of the spoken word "dog", they were training the individual to select a picture that matched the spoken word and also to select a written word that matched the spoken word. After a considerably long training in these kinds of conditional discriminations, some relations emerged between printed words and pictures that were

not explicitly trained. So, basically, the individual spontaneously started matching printed words with pictures, and this learning was emergent. It was not directly trained: no contingencies of reinforcement had been programmed for this emergent performance. The concept of stimulus equivalence kept refining over the years, and basically it was defined by a series of formal properties when you use– when you train conditional discriminations; usually employ matching-to-sample procedures.

The idea is that stimulus equivalence should fulfil these– or have these properties. The first one is reflexivity: when you are presented with a stimulus, you should be able to select the same stimulus when it is used as a comparison. We also have symmetry: when you are training a conditional discrimination and you learn the discrimination in one direction. In the presence of a written word, you are trained to select a specific picture. You should be able to produce the reversible relation (symmetry): when you are presented with the picture, you should be able to select the corresponding printed word, even though that selection was not explicitly reinforced. And then we have transitivity, that involves at least two stimulus relations. For instance here, if I [learned to select] the a picture of a dog in the presence of the written word dog, and I also learned that how to select the the Spanish word "*perro*" in the presence of the written word dog, then untrained relations between the picture and the the other printed word —i.e., the Spanish word— will emerge. I will be able to learn to select "*perro*" in the presence of the picture of a dog and to select the picture of a dog when I'm presented with the word. So, basically, I'll be able to combine those relations and, as you will see, some of those relations are marked with a solid line. Those are relations that were directly trained, so contingencies of reinforcement were provided. The relations that are marked with a dashed line are untrained emergent relations.

These properties and this kind of transitivity-symmetry relations are very easily demonstrated with verbal humans, with verbally-skilled humans, but not with pre-verbal infants, individuals with severe verbal deficits, or with non-humans. I mean,

there's some controversy around that, but we don't have lots of evidence that non-humans are very good at, especially at getting symmetry in the lab; at reversing conditional discriminations. Obviously, the fact that these performances are untrained or emergent made Sidman connect this with language and the whole idea that perhaps they were a good model of the symbolic properties of language, of how words stand for the reference or the objects they are supposed to represent in the world. Sidman suggested that equivalence might be a basic stimulus function that is unique to humans, and would explain the symbolic and referential nature of language. Some other theories, e.g. the naming theory (Horne & Lowe, 1996) suggest that it is language that is necessary for equivalence to occur. So you have to be able to name the stimuli in an equivalence class for stimulus equivalence to emerge. And then, as far as I know, in the mid 80s Stephen Hayes came up with a different alternative according to which the relating behaviour observed in stimulus equivalence was indeed a class of generalised operant behaviour. So, it is operant behaviour that is learned through early language acquisition –history of multiple exemplar training. Both stimulus equivalence and the symbolic properties of language were functionally the same. and also an important thing, that this form of relational responding was not limited to equivalence relations, or what we have termed "coordination" in Relational Frame Theory, but other forms of relating were also possible, like: two stimuli can be different, or one of them can be more than the other, or they can be in opposition etc.

RFT explains the behaviour of relating stimuli and basically the properties that relating behaviour must have from the point of view of relational frame theory are, I would say, are a bit more generic than symmetry and transitivity. The first one would be mutual entailment. Mutual entailment basically is about the bidirectionality of stimulus relations. If you relate a stimulus to another, if you relate A to B, then B should be related to A in a specific way: in equivalence or coordination or sameness. This very straight forward, just like in stimulus equivalence research if

A = B, then B = A. But you also can have relations of difference: e.g., if A is not the same as B, then B is not the same as A. Opposition: if A is opposite of B then B is opposite of A. Comparison ... and a multitude of potentially different patterns of relational responding. So if I learn that a videogame system costs more than a book, which my 8-year-old is learning these days, she will very easily derive that a book costs less than a videogame system, even though I don't have to explicitly train her with that relation. Combinatorial entailment involves a combination of at least two stimulus relations or three three stimuli. So if you relate, let's say, A—B and B—C, then some relations should emerge between A and C. So, in the case of coordination, if A = B and B = C, then A = C and C equals A, and this is just like transitivity and stimulus equivalence. But then you will have that combinatorial entailment has– combinatorially entailed relations are not necessarily specified depending on the on the kind of relations that were mutually entailed. For instance, in difference relations. If I learned that A is not the same as B, and B is not the same as C, I will not be able to know what the exact relation is between A and C.

Or also the combinatorially entailed relation needs not be the same as the mutually entailed relation. For example, in aframe of opposition, if I learn that A is the opposite of B, and B is the opposite of C, then the relation between A and C is one of sameness. So if I learn that happy, an English word, is the opposite of sad, and that sad is the opposite of the Spanish word *Feliz*, I can derive that *Feliz* is the same as happy. With comparison frames, you will have the same as with difference. Depending on the kind of directly trained and mutually entailed relations, it might be difficult or not possible to specify a combinatorially entailed relation. And, finally, the basic property or core property of relational framing is transformation of functions. Transformation of functions is possibly the property that makes derived relational responding psychologically relevant. It involves the alteration of the function of the stimuli that are in a relational network in accordance with the entailed relations in that network.

When I have learned that a set of stimuli are related and they have specific relations amongst them, providing or training one of those stimulus to acquire a specific psychological function, depending on contextual conditions, might just change the psychological functions of other stimuli. This is, as I mentioned before, the property that makes the relational responding psychologically relevant. It is by means of transformation of functions that different parts of the environments, events, stimuli acquire their psychological properties without direct experience. So, for coordination relations this is very straightforward. If I have 3 relations of sameness: A is the same as B, B is the same as C, and I learn that one of them is dangerous, then the idea is that these functions will transfer to other elements in the network, so C would be dangerous. Obviously, if the relations are of opposition, and I learned that A, for instance, is appetitive, then B would be oppressive and its relation would change. And with comparison, if I learn that A is more than B and B is more than C, and then I learn that C is dangerous, perhaps C is a dog and I had a bad experience with a dog, it bit me or I was attacked, and then I learn some relation like "Uncle Mike got a very large dog called Logan; let's go meet Logan", what would happen? The simple fact of thinking of meeting these dog, which I've never seen, I have actually never been in contact directly with this stimulus, the fact of knowing that it's just larger or "more than", might generate a strong fear reaction. And and I think you can see how this starts being relevant in psychopathology: the fact that stimuli can acquire psychological functions that might be relevant, like fear or appetitive functions, without direct experience with those stimuli.

These core basic properties, mutual and combinatorial entailment and transformation of functions, refer to different aspects of contextual control. In relational frame theory, there's a distinction between the contextual cues that control the entailment of relations, i.e., the type of relations that is established and derived between stimuli (for example, if I learn that Logan is a dog, I'm learning a coordination relation, or that Logan is lar-

ger than other dogs, you’re learning a specific relation between dogs and this new element, this new name, Logan); and there is another set of contextual cues that control transformation function. They control the specific behavioural function that will be produced upon those entail relations. And this is an important distinctions. Cfuncs, or functional cues, are cues that specify the relation. That is derived. So I’ll give you an example with the same thing with dogs: if I have a child that was bitten by a dog and then I learn a relation between an new stimulus then name Logan and dogs, so “Uncle Mike got a very large dog called Logan, let’s go meet Logan”, possibly I might have this transformation: a potentiation of the fear properties of Logan. But then I might also learn that Logan is friendly. Say I get this information. This is not about the relations that Logan has with dogs. So the relation is the same: Logan is larger than other dogs, but it actually uses the psychological functions. So perhaps in my history I have this distinction between a dog that attacked me and friendly dogs, friendly dogs wag their tails, they go after you, you can pet them... So, the very fact that I’m learning “Logan is friendly”, even though it’s still in a comparison relation with the general category of dogs, changes the function so that when I think of dog and meeting Logan, I’m happy with that.

So these core properties of relational framing or arbitrarily applicable relational responding constitute a basic behavioural unit of analysis for the study of language and cognition. And these would be the very basic properties of relational framing. And it’s important at this point to point out the distinction between arbitrary and non-arbitrary relational responding. Nonarbitrary relational responding is based on the formal or physical properties of stimuli. This is something that non-humans, with adequate training, apparently can do very readily. So you can teach animals to, for instance, select the larger of two stimuli and basically they end up learning that it’s the relation between the stimuli, and not the stimuli themselves, that controls their responding, So even if I consistently reinforce selecting the larger of the two stimuli, even when I present a novel pair, a stimulus

that you've never seen, but the relation is kept constant, non-human animals might be able to respond based on that relation. Now the thing is: we assume somehow that humans operate similarly, but all of that relational behaviour, nonarbitrary relational behaviour, is learned under the control of contextual cues, verbal contextual cues. So when I'm teaching my child that something is bigger than some other thing, and they are actually, and that relation is actually controlled by the physical properties of the stimuli, I'm just telling them that a basketball ball is just larger than a golf ball, I will be using verbal formulæ like "is bigger than", "is larger than", etc. Eventually, those verbal stimuli will be applied to stimuli that actually are not related on the basis of their formal properties. So this is why, for instance, humans can use these cues to establish a relation between, for instance a physically tiny Leo Messi and a considerably larger Cristiano Ronaldo, some people can learn that symbolically. I don't agree with this, but it's just... Messi is bigger than than Cristiano, so our relation that was originally learned, relational behaviour that was originally learned on the basis of the formal or physical properties of stimuli, can be arbitrarily applied based on social convention.

MET: Multiple Exemplar Training

And this and a very, very important aspect in RFT: this occurs through a history of multiple exemplar training (MET). So when you are acquiring language, when you are learning to behave verbally with your verbal community and contingencies of reinforcement for establishing relations between stimuli across a multitude of different exemplars, different objects, different stimuli will just conform a generalised relational operant. So, once you learn to relate stimuli and you get to the point that you can apply that learning to any sort of behaviour, once you have abstracted what "bigger than" means, I can tell you that A is bigger than B. You have no idea what A is like. You have no idea what B is like, but you will be able to derive that B is smaller than A. I think a good way of explaining this is what happens with how we learn to name, to use names. So, I'll just give you a few examples. A toddler is learning to orient or point to an object upon hearing its name. So I see a dog, and my dad tells

me “it’s a dog”, the spoken word “dog”. Then, the next time I hear the word dog (my dad, for instance, asks me: “hey, where’s the dog?”) and I point to the dog, or I orient towards the dog, there is explicit– and there’s direct reinforcement for doing that. “You know what a dog is! It’s the first time you heard the word, or the second time, and you correctly oriented towards the dog”. Also, it’s possible that if I have an verbal productive repertoire, I can imitate words; when I see a dog, I will say its name and I will also receive– you will be presented with contingencies of reinforcement for that. So think of the first time the toddler just says a name for anything, “My kid is super intelligent now. He’s growing up” or whatever. He saw a dog and said “a dog”. And this happens with all explicitly reinforced– so the different relations between names, objects, spoken names, pointing, orienting all of them are explicitly reinforced. And this happens with dogs, this happens with cats, this happens of course with mum and dad, this happens with food, this happens with everything: all sorts of objects and events in the world, and there’s a lot of reinforcement contingencies for establishing relations between these stimuli all possible directions.

Now it gets to a point where this relational behaviour is generalised to the point that you only need to be exposed to one of those relations, to one subset of them; so a toddler might be in the presence of a completely new object, like a robot toy, and learn “it’s a robot”, and then spontaneously the child will just be able to point to the robot upon hearing its name and say the name “robot” upon seeing the object, and there will be no explicit reinforcement contingencies for this. This will have been established as a generalised operant that can be applied to any sort of stimuli in the world. And actually we did research with this. A paper published in 2007 (the lead author was Carmen Luciano) about how to establish this repertoire in an infant (Luciano et al., 2007). She was 16 months and 25 days when she saw the emergence of what we call receptive symmetry: the capacity to point to an object or orient towards an object upon hearing its name. Previously, this child was presented with the object and heard

the name, and then three hours later you ask for the object and the child is able to select it from a set of other objects. This involves training with a large set of objects. In the lower part of the graph (Fig. 1.2), it's like 12 or 13 different objects, and then a test was conducted with seven novel objects from 14 to 21, and in all cases but one (object 17) the child was able to spontaneously point the object upon hearing its name. And then, the study is more complex. Basically at a later age when the baby was 19 months, visual-visual relations were trained and, as far as I know, it was the earliest evidence of equivalence in a human; she is the youngest person who showed equivalence relations.

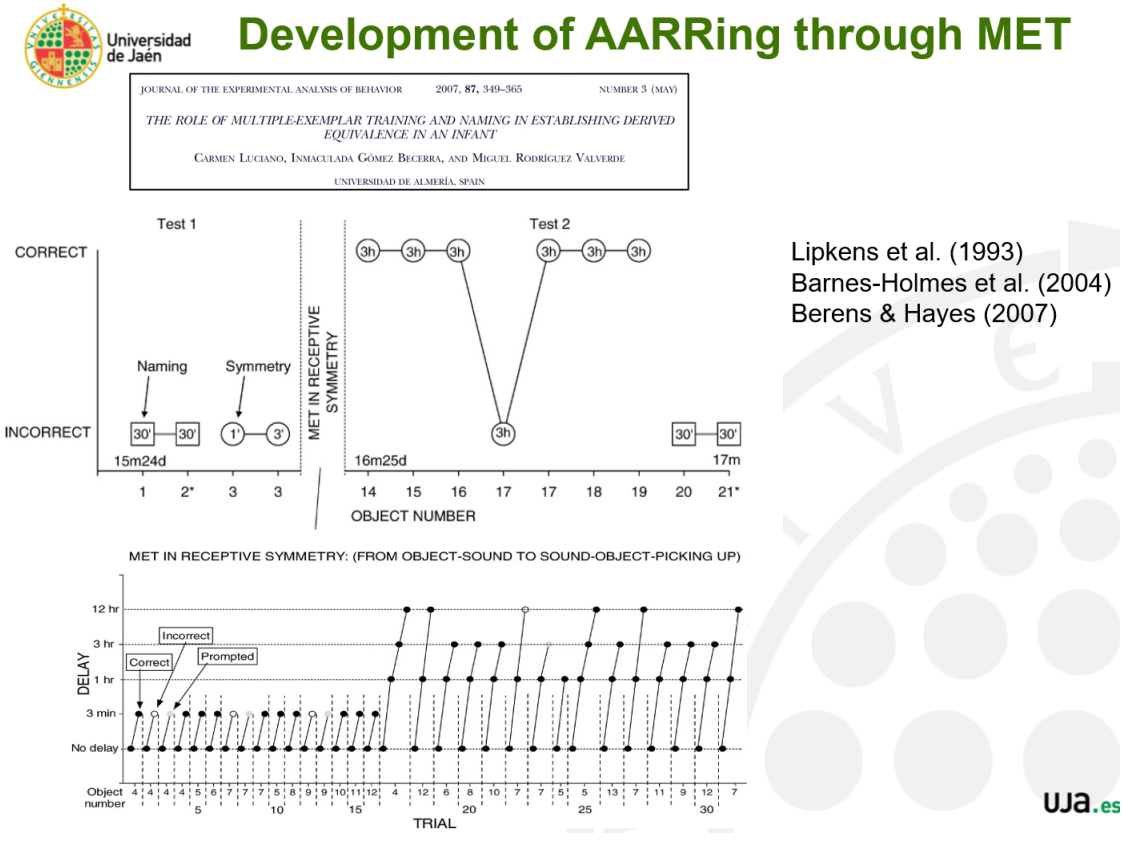

Figure 1.2: Figure from Luciano et al. (2007).

Once arbitrarily applicable responding has been established, it develops into increasingly complex relational responding. So far, we have seen the combination of mutual and combinatorial entailment and transformation of functions to somehow define what a relational frame is. But those frames combine into in-

creasingly complex relational networks. And then, it’s also possible to relate relations with other relations, like they were stimuli, basically discriminating the relation between two stimuli, discriminating the relation between another two stimuli, and (I will go into that later) then establishing a relation between them, which would be the RFT basis for analogy and metaphor. And also, relational networks can combine with other relational networks, making it increasingly complex.

Different patterns of arbitrarily applicational relational responding have been demonstrated in the lab with different preparations; not only matching to sample, but with other preparations, like the relational evaluation procedure. So we have evidence about coordination relations, distinction and difference, opposition comparison, temporary relations, hierarchical relations (which are more complex), and eieictics which are specific types of relational behaviour having to do with individual perspective (the distinction between “I” and “you”) and the spatial component (the distinction between the “here” and “there”), and the temporal (distinction between “now” and “then”). I will go into that a little later, but before we go into more complexity, because the relational frame theory has been updated and this idea of the increasing complexity of relational networks has even been conceptualised into a model, the HDML model, I think it’s relevant that we review the extent to which even basic research on transformation of stimulus functions has an impact and has provided relevant findings for an understanding of psychopathology.

I will start with the experimental analysis of fear and avoidance. Why fear and avoidance? Because fear and avoidance are involved in most forms of psychopathology, but more particularly in the anxiety disorders. The behavioural approaches to the ætiology of anxiety disorders have relied very heavily on fear conditioning; this is the key process explaining how humans acquire fears that are relevant in clinical terms and also fear conditioning and avoidance learning as the key processes. We have the obvious little Albert example, poor little Albert, who underwent aversive conditioning with Watson. This is the iconic pop cul-

ture example of how fear is acquired by Pavlovian conditioning, including generalisation. Now we know that fear conditioning and avoidance are central in experimental psychopathology, and there's a vast experimental literature on the acquisition of fear eliciting and avoidance of evoking functions by stimuli that were previously neutral. Basically by pairing them with a significant aversive stimulus, or an unconditional aversive stimulus. But the clinical evidence shows that the direct contact with an aversive event is often not necessary for fear and avoidance to occur. So we know that there are in many instances where people have specific phobias or other anxiety disorders, and there's a lack of personal history of direct aversive conditioning. There's also this phenomenon, I think it was first described by Martin Seligman: the selectivity of fears and phobias or the fact that not all stimuli seems to be equally potent in producing fear conditioning and the fact that some phobias are much more frequent than others; for instance, phobias of snakes are much more frequent than phobias of drills or other tools that might actually harm you much more likely in the industrialised world than snakes. We will rarely have a direct conditioning experience with snakes.

This has also led to ideas that phobias have some degree of biological preparedness. Snakes, spiders, heights, storms would have phylogenic component, so these would be events that are very readily to be associated with aversive stimulation. So, in social difference this has been typically accounted for us in terms of generalisation. Generalisation is about the transfer of eliciting properties to stimuli that are similar; either physically similar as in perceptual generalisation, or conceptually, semantically similar. And here they they do not have to be physically alike. So, perceptual generalisation. This is a relatively recent example. Perceptual generalisation has been studied as a process for a very, very long time. But I would say that there is a very, very renewed interest in fear generalisation in general, and this is a study by Shmuel Lissek et al. in 2008 (I think this one is published in Behaviour Research and Therapy) where they obtain a very, very nice generalisation gradient to circles differ in size. You see the

little bolt over circle #10. This was used as a positive conditioned stimulus. It was paired with electric shock. And then #1, the smallest circle, was used as the CS−. It was presented in a differential condition in preparation. It was never followed by shock. And then you see that the intermediate sizes, all of them, when they are presented, they produce physiological responses: in this case, blink startle, or as we call, fear-potentiated startle, in accordance with their degree of similarity or dissimilarity with the aversive conditioned stimulus.

Conceptual semantic generalisation is a very, very old topic. It dates back to the 1930s and the 1940s and just giving you an example of a very old research by Riess (1940). They use the word "Urn" (I hope I'm doing my pronunciation correctly) as a conditioned stimulus. It was paired with electric shock, and then they tested with the words "Earn", which would be a homophone (sounds very, very similar) or the word "Vase", which doesn't, which is not physically similar or it doesn't sound the same, but it's semantically related and they would have stronger fear reactions, stronger conditioned reactions to the word "vase". This is very old research, but again, conceptual and semantic generalisation of fear are now the focus of great interest in basic experimental psychopathology research. I'll just give you a much more recent example by Dunsmoor et al. (2011), they used what we call a sensory preconditioning preparation. I don't know if you're familiar with sensory preconditioning. In sensory precodnitioning, you have two neutral stimuli, neutral in the sense that they have not been directly paired with an unconditional stimulus, for instance the picture of a spider, and then the picture of a spider web, you present them together, and after that, you take the 2nd stimulus, the conditioned stimulus, you pair it with shock, and then you test, with the precondition stimulus, if it produces a fear reaction, even though it's never been paired directly with shock. This called sensory preconditioning. Now, what these researchers did is they established sensory preconditioning in a differential conditioning preparation that was either matched or unmatched relationally or semantically. Basically, if you pair a

spider with a spider web and a wasp with a wasp nest– by the way, this was all counterbalanced, but I've just used the example where you get the the shock with the spider-related stimuli; and then you have a mismatched condition where the sensory preconditioned stimuli were mixed: so the spider predicted wasp-net and the wasp predicted the spider-web. And then you have a completely unrelated condition where the spider predicted a waste drum, and the the wasp predicted (I don't think you see it very clearly, but that's) a hospital corridor, OK? And now they tested all of these three groups, and what they saw is that when there is a semantic relation between the sensory preconditioned stimuli, the sensory preconditioning is much stronger. You get stronger fear reactions to the spider if the shock was presented with that semantically related stimuli.

These are all associative accounts and are supposed to refer to associative processes. And obviously, stimulus equivalence and derived relational responding provide an experimental model of how emotional functions are transferred and transformed, or, if you will, how they can generalise symbolically or conceptually. Now, this kind of research (I did my PhD thesis on this topic) typically involves the formation of novel relational networks in the lab with abstract stimuli (stimuli that are not physically similar, that are not semantically or conceptually related in the in natural language), the direct conditioning of emotional fear eliciting functions to some element or elements in the network, and then a test of the transformation of the functions of the other elements in the network. This research was pioneered by the late Michael J. Dougher of the University of New Mexico, who recently passed away and I just wanted to remember him here, because I think his work was an inspiration in this area of research linking the relational responding and experimental psychopathology.

Those three papers, the transfer of fear in accordance with equivalence classes (Dougher et al., 1994), transfer of avoidance in accordance with equivalence classes (Augustson & Dougher, 1997), and the latest one, which is the transformation of discriminative and eliciting functions in accordance with the rela-

tional frame of comparison (Dougher et al., 2007), I'll just explain these. I will explain it using my own work. This is part of my thesis (Rodríguez-Valverde et al., 2009), this was published in 2009 and I just wanted to explain it to you to see how basic research in derived relational responding might help explain some relevant themes in psychopathology. For instance, how human fears are acquired. So this paper provides a demonstration of how fear spreads to safe, physically dissimilar stimuli, based on an experimentally derived coordination relation with an aversive conditioned stimulus. It also demonstrates that this effect is flexible and it changes after a contingency reversal. It talks also a lot about the C_{func} properties, not only the relational properties of the network. In my view, it is important because it it gives evidence that is relevant both at the group and the individual level. Basically, the study consisted of the formation of two equivalence classes using matching to sample, two 5-member equivalence classes with a one-to-many training procedure, and then the test of all the ensuing mutually entailed and combinatorial entailed relations. So basically you have two sets of five stimuli each, and then some of those stimuli in one of the classes are paired with shock. They are paired with an aversive, an unconditional aversive stimulus. This is just a picture of an actual physiological record. That's a skin conductance response, possibly one of the simplest psycho-physiological measures you can take. The blue line basically is the marker for how long the stimulus was on the screen, 8 seconds, and then shock was presented at the very end when the stimulus disappeared. And you see this anticipatory increase in skin conductance that basically is a form of arousal, an increase in arousal when you are presented with that stimulus. And you see it happens prior to the presentation of shock, so it's not an unconditioned response.

So, once the two stimulus classes were formed, the two elements from class 1 (i.e., B1 and C1) where systematically paired with shock across blocks of training. Then, another three blocks followed, where the remaining elements in each class, the D and E elements, also underwent the same contingencies, but it's crit-

ical here to point out that the first time this aversive conditioning occurs for the D and E stimuli is actually a transfer test, because they've never been paired before with the shock. So the first time you measure the physiological responses in the presence of D1 and E1 and D2 and E2 is a proper transfer test, in the sense that the reaction they are producing hasn't been directly trained. After that, there was a reversal in contingencies. So two elements that were presented in extinction, this is a differential conditioning procedure, so these elements that have never been paired with shock now are paired with shock and two elements that have been shocked before from class 1 are now presented in extinction. After this reversal training, you go on with the remaining elements in the class and you see: this would be a reverse transfer test, so you get the chance to test if the functions of the remaining elements of the class have changed upon changing the aversive conditioning contingencies for only a subset of those elements.

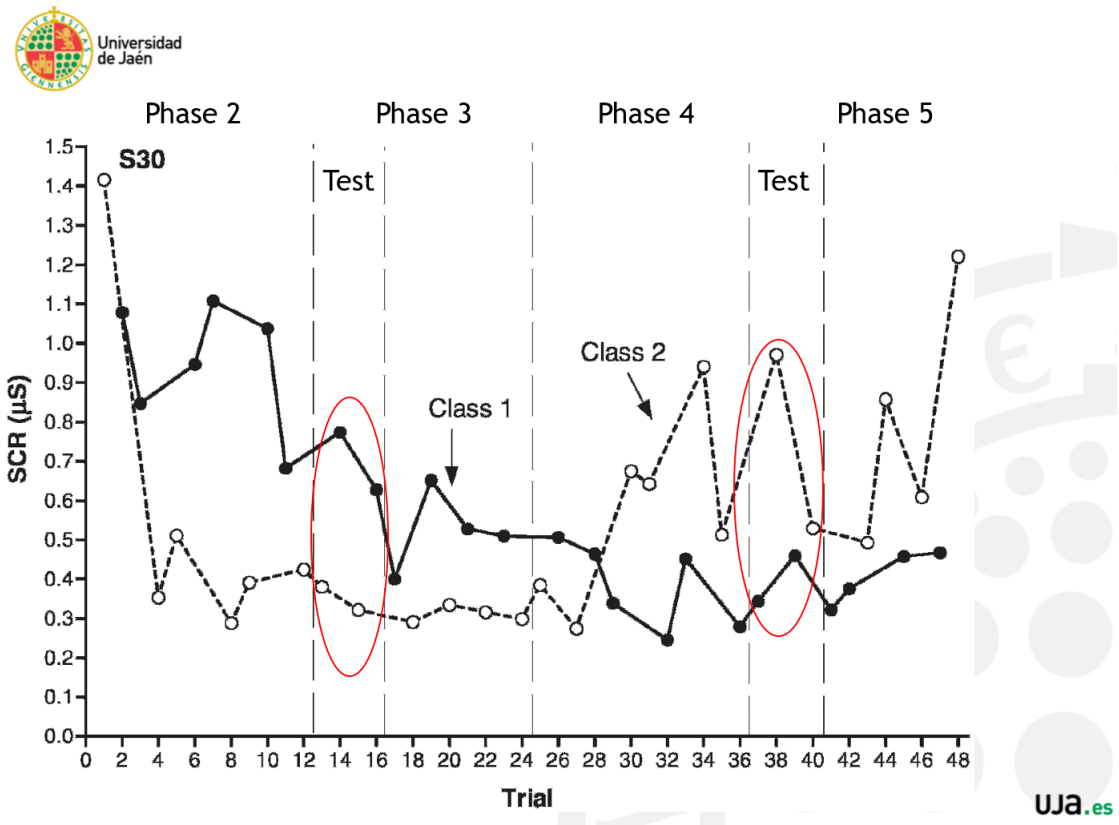

Figure 1.3: Subject 30 from Rodríguez-Valverde et al. (2009).

This would be the results for an individual participant: subject 30 (Fig. 1.3), which I call my star subject because it was the one who showed the most orderly pattern of transfer, both in accordance with the original contingencies and after the reversal. So basically, what you have here is: this would be D1 and E1 and this will be D2 and E2. This is the first time D1 and E1 show a not directly conditioned, strong fear reaction that is measured as an increased in arousal only by virtue of their equivalence or coordination relation with the directly trained stimuli. And, when you change those contingencies, you also get a transformation of the functions of for the Class 2 elements and this is interesting because these are elements that actually have a history, a direct history of being presented in extinction. They have never been paired with shock, and they have been presented in extinction for a few trials. But when you change this emotional function of only a subset of elements, they show strong fear reactions compared to the other class. This will be an individual participant and that and this is how we wanted to measure it. We wanted to make sure that participants would show more fear to all of the elements in one class than to the elements in the other class. That would be the real test that transfer was being produced. We get very similar effects at the group level. But actually, if you see, those are the proportions or the percentages of participants in the upper part. Basically what we had was 14 participants out of 17, more than 80% showed the pattern of transfer of functions. It's 17 because that's the amount of participants who actually got differential conditioning. This is a fixed number of trials, so you might try to get differential conditioning but not get it in the lab. So this happens. But still if you take the complete sample, which was 26, more than half of the participants showed this transfer effect on the test (Fig. 1.4). What I'm trying to say is you can get because this is the kind of group results that you would get in a typical psychophysiology article with a group design, you get significant effects, but it doesn't really reflect the fact that a large number of participants is actually behaving the way you expect.

In a more recent paper (Rodríguez-Valverde et al., 2021), we

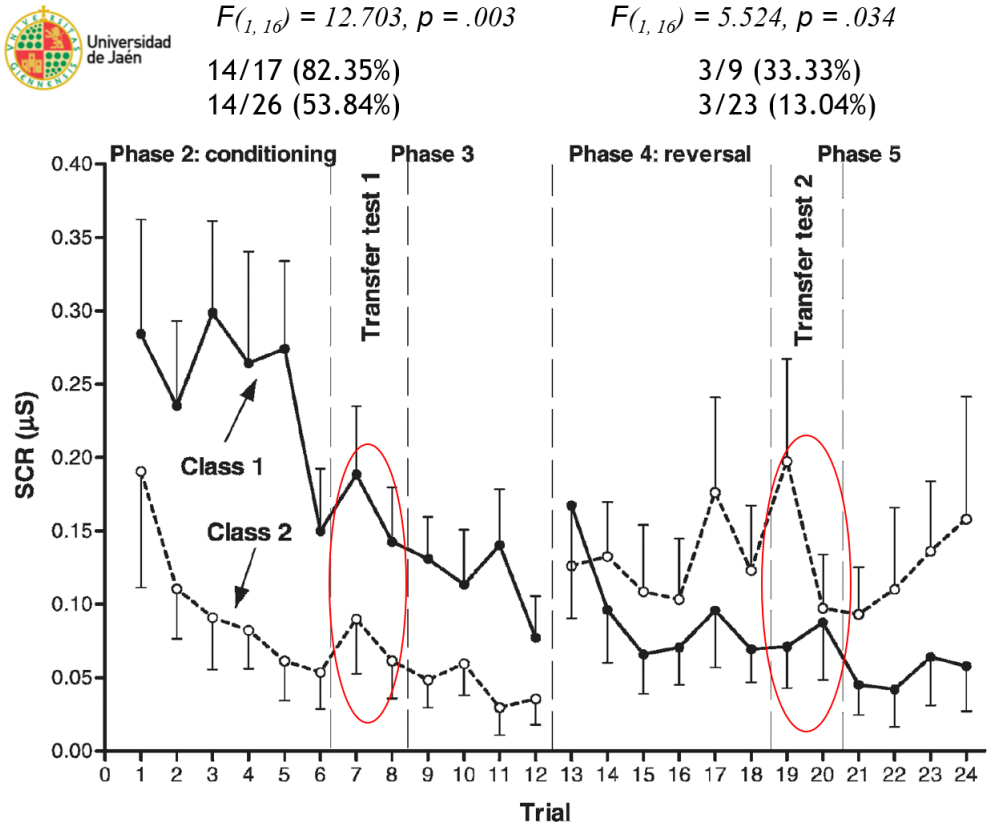

Figure 1.4: Participants in Rodríguez-Valverde et al. (2009)

studied the same phenomenon, but also with avoidance behaviour. So the design is pretty much the same, and I will not stop into it. The main difference is that, in some trials, besides fear conditioning, we also measured avoidance behaviour, so in this case the trial was divided into parts. It was still an 8 second CS duration on the screen, but for the first 5 seconds we measured the physiological responses, skin conductance and heart rate, and then for the last three seconds, contextual cue showed up on the screen and participants could produce a response that would cancel the stimulus on the screen and would prevent the presentation of shock. I can explain it better with an example. It was a differential aversive delay conditioning procedure. You had purely a aversive classical conditioning blocks where you will have the stimulus on the screen for 8 seconds and then the presentation of shock, and also you would have avoidance trials where the stimulus would be on screen for five seconds, then a

contextual cue would show up and you would have to produce an avoidance response: in this case you had to press the arrow keys on the keyboard that matched the arrow on the screen. So, if you have an arrow pointing to the right, you would have to press the right arrow key. If you pressed at least five times during three seconds, the stimuli were cancelled: no shock. If you fail to do that, you get the shock. The design is just the same we used in the prior experiment, but in this case we have obviously a strictly Pavlovian classical conditioning and then and avoidance training phase. What you have is –and it's important to mention that both responses were measured concurrently– what you have is: avoidance behaviour is very clearly controlled by stimuli that are only related to other stimuli under which avoidance has been trained. And an important result, in my view, is the fact that after the contingency reversal, the transfer of avoidance is even stronger than originally. It makes sense because those C_{func} parts of training made the whole network more coherent, more consistent. On the bottom of 1.5 you have the data for skin conductance, which was not as clear as in the prior experiment. So the concurrent measurement of both responses shows us that, when you have the possibility to avoid, arousal does not keep high.

We also have preliminary evidence of transfer and transformation of function with fear-potentiated startle. This is not yet published. This is part of a funded research project that I had a few years ago, but we haven't submitted it – the only big thing is: we used fear-potentiated startle because it's supposed to be a better measure, a better physiological measure of your conditioning. This is electromyogram of the *Orbicularis oculi* muscle in the eye. And then you are presented with a sudden burst of white noise and you produce something like a blink, and this can be recorded. Now, the thing with this blink startle is: it appears to be very sensitive to the affective valance of stimuli. So if you are presented with unpleasant stimuli, this will potentiate the startle response; if you are presented with pleasant stimuli, this was will attenuate your startle response. Also, it's supposed

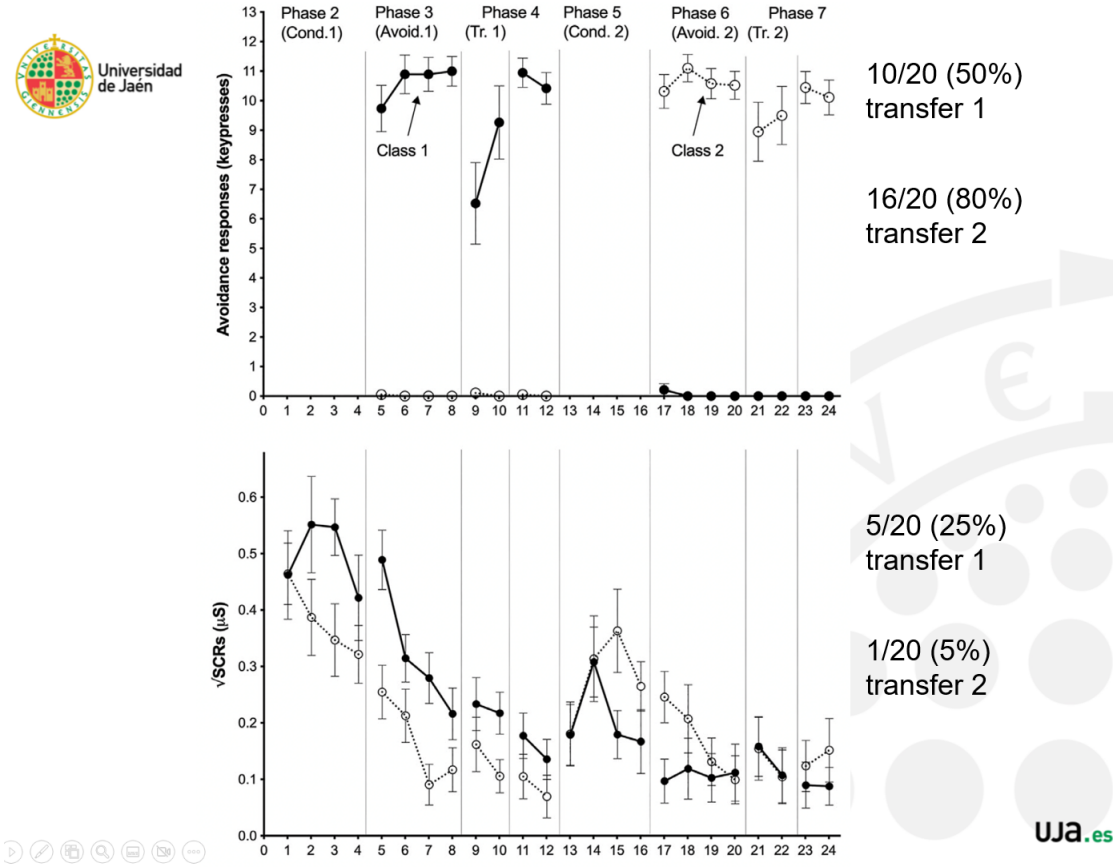

Figure 1.5: A Figure from Rodríguez-Valverde et al. (2021)

to be very difficult to influence voluntarily, and it's increasingly used in psychophysiological research and fear conditioning. It's supposed to be better than skin conductance. In any case, the design was pretty much the same, but with no reversals. The results we got here are relevant only at the group level, and they're not very strong. This is with the startle reflex (Fig. 1.6). You get a significant ANOVA, a significant class effect for an ANOVA. No interaction, no trial effect. But you wouldn't get a very clear pattern of responding at the individual level, so we didn't have many individual participants that showed this effect. It wasn't a substantial part of the sample, and this is also the same with electrodermal activity or skin conductance.

And finally, I will finish my presentation of the experimental analysis of fear with transformation. All of the research I have presented thus far has to do with relations of coordination, equi-

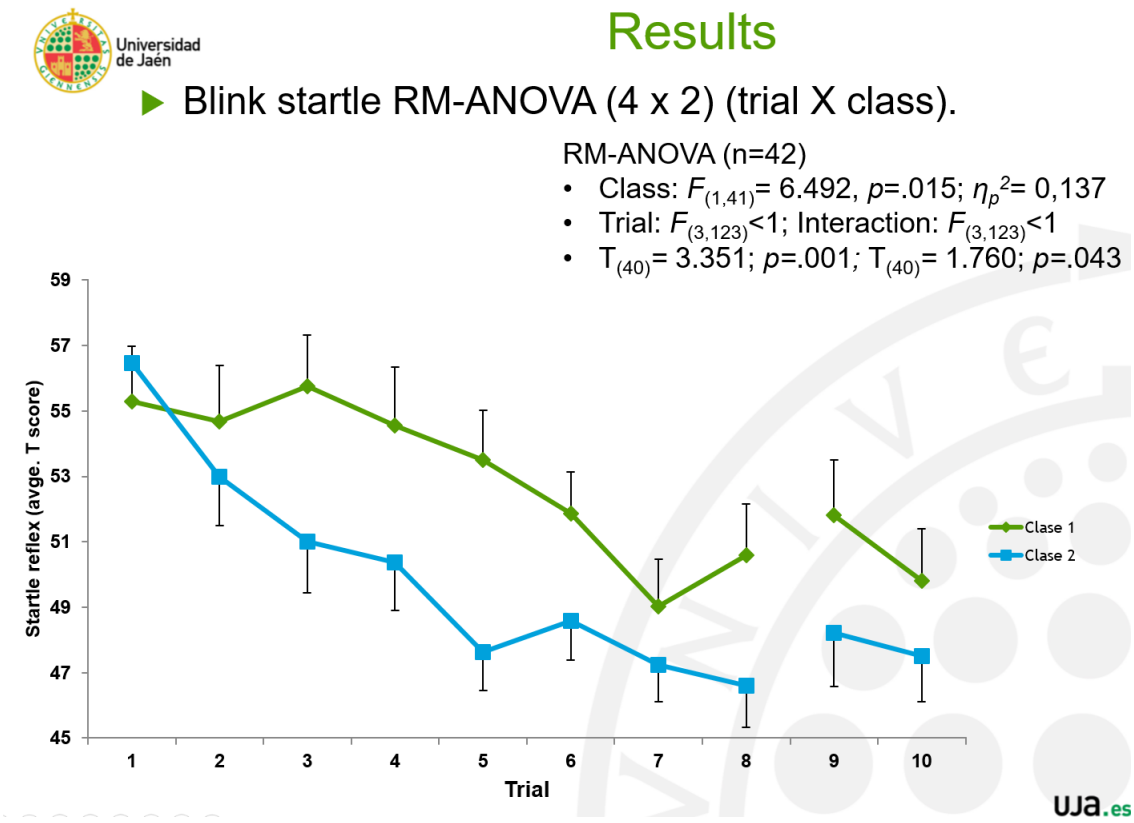

Figure 1.6: Unpublished data by Rodríguez-Valverde

valence, sameness. There is very little evidence –I think it’s this 2007 article by Michael Dougher and his colleagues– that fear can be transformed; it can increase or decrease depending on the relations established in the relational network. So, this is the last part of my thesis. Much to my embarrassment, It’s not published yet, even though it was made a long time ago. But I want to explain to you very rapidly because I think it illustrates an important part and it’s the influence of both the C_{rel} and the C_{func} components in the transfer and transformation of fear. So what we set out to do here was to see if fear reactions will transform; if they will increase or decrease according to a relation of comparison. So, when you learn that some stimuli are *more than* some other stimuli, will they produce more fear? And we had to train this with a multiple example training. It was very difficult to do this with a single relational network. We have to train this over several different relational networks, so that par-

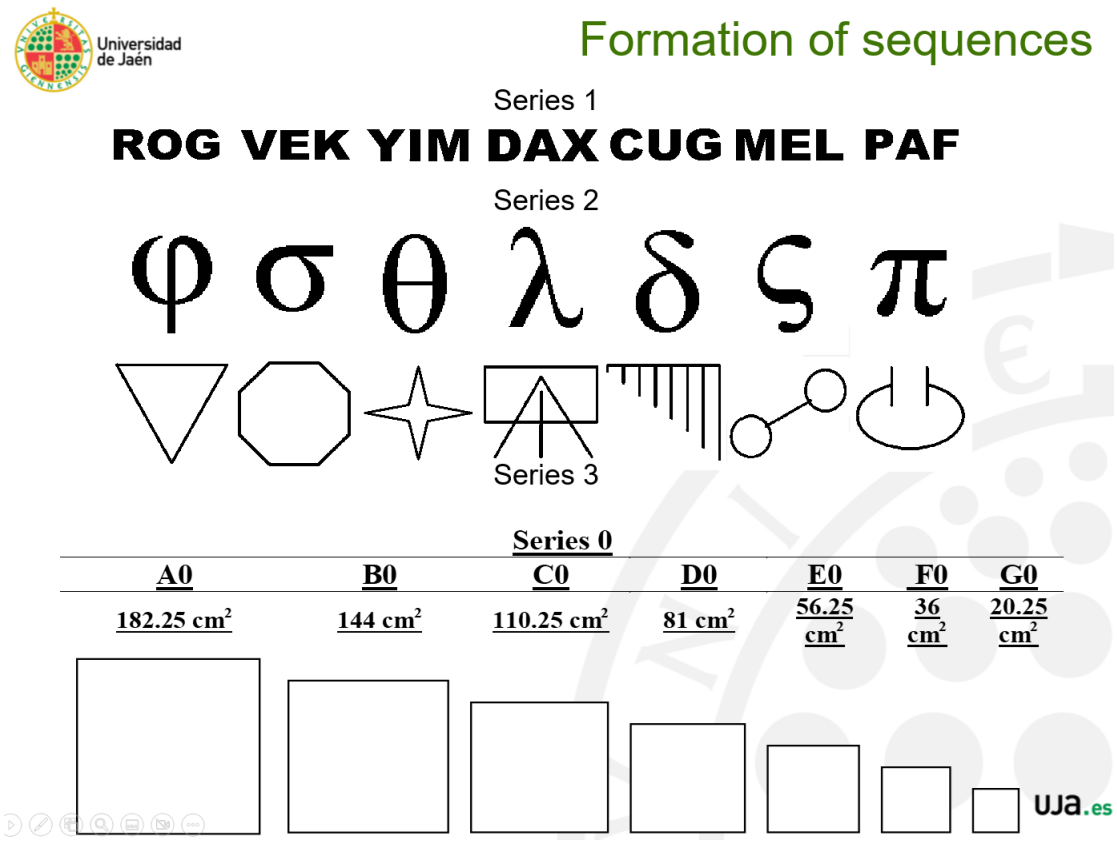

Figure 1.7: Stimuli used in unpublished research conducted by Dr Rodríguez-Valverde on the transformation of functions according to relations of comparison.

ticipants could abstract this whole set of relations. And we had to start with those squares –you see on the bottom part of 1.7– as a non-arbitrary prompt, so this was very straight forward for participants. They just had to choose which of the two squares was larger[1].

[1] In trials depicting any two of Series 0 stimuli; i.e. in pairs (Transcribers' Note).

Once that was established, which was almost automatic, we introduced arbitrary stimuli: nonsense syllables, but they were still framed by these squares. So basically you were choosing, let's say, Yim over Dax, you were selecting Yim over Dax, but you you had this idea that somehow Yim was equivalent to the larger of the two (see 1.8). Then, this prompt was faded overtime, so that eventually you only had what we call a transitive inference training: selecting some stimuli over others without a non-arbitrary prompt.

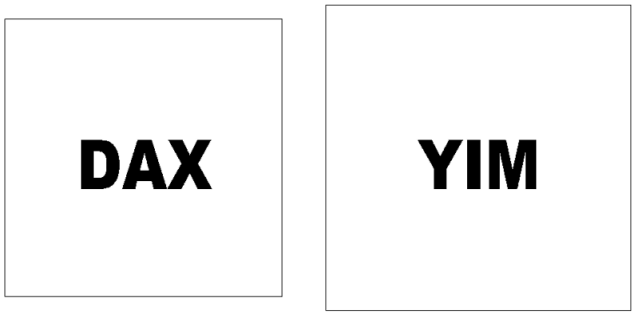

Figure 1.8: A trial with nonsense stimuli framed by squares.

And we trained this with nonsense syllables, with Greek letters, and eventually with abstract pictures. That would be what we could conceptualise as the C_{rel} training part. So the part of training that is concerned with the type of relations that you are training in the network. Relational network 1 was the nonsense syllables. After that, the middle term in the sequence, the middle element, was paired with a mild auditory stimulus, 90 decibels. They were different frequencies, so this was not particularly sharp, 1.5 second duration. A smaller element was paired with a softer auditory stimulus, and the larger element in the class was paired with louder auditory stimulus (see 1.9). This was done with the syllables. This is what we would call the C_{func} training: basically, you have these relations: “this is more than this”, “this is more than this”, but how does this affect a particular stimulus function? Well, you learned that the largest stimulus predicted stronger sounds.

And we had two control conditions. One of them removed the C_{rel} component of training. So basically you would have participants learning that the D element predicts a mild auditory stimulus, the B element predicts a loud auditory stimulus, and the F element predicts a soft auditory stimulus, but they have no idea about the relation between those elements. And control 2 removes C_{func} training, so you have the sequence, but you only have the mild auditory stimulus for the middle element.

And finally, we tested the transformation of fear with a third set. This was the abstract pictures, the abstract drawings, and then here when we did is– we trained with the middle element

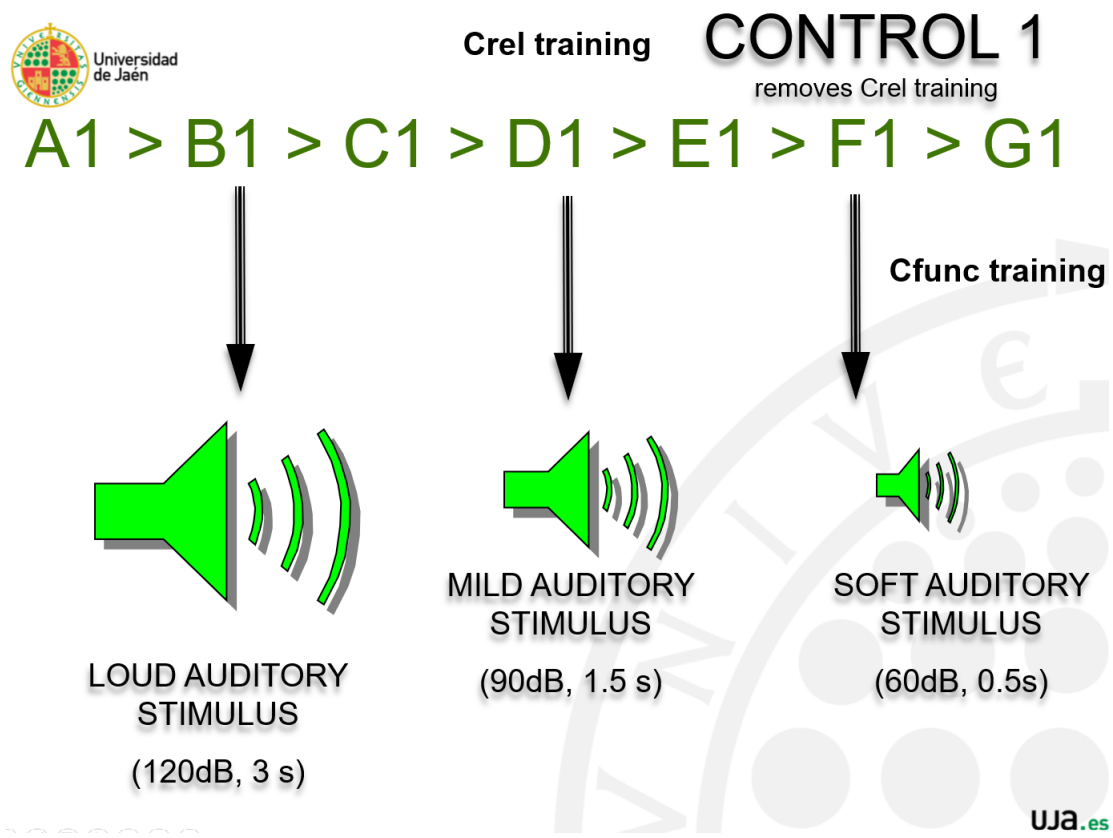

Figure 1.9: C_{func} training.

with a mile electric shock and– well, I don't know to what extent you can say it was mild: it was 500 milliseconds, which is quite a lot. But it is what we would call mild. And then the smaller element was paired with a softer shock, it was shorter, but the current was kept constant. And the larger element was paired with stronger shock. And these were direct contingencies, I mean, they were actually presented with the shock. But remember: this is delayed conditioning, so the first time the stimulus is on the screen, you can measure physiological responding before the shock is presented.

So, 50% of participants actually showed a pattern of fear reactions that was consistent with our criterion, which was to show stronger fear reactions to the B element (the larger element) than to the D element, and in turn the directly conditioned fear reaction to the D element should be stronger than that for the smaller element. this is 50% of participants (who) would cover

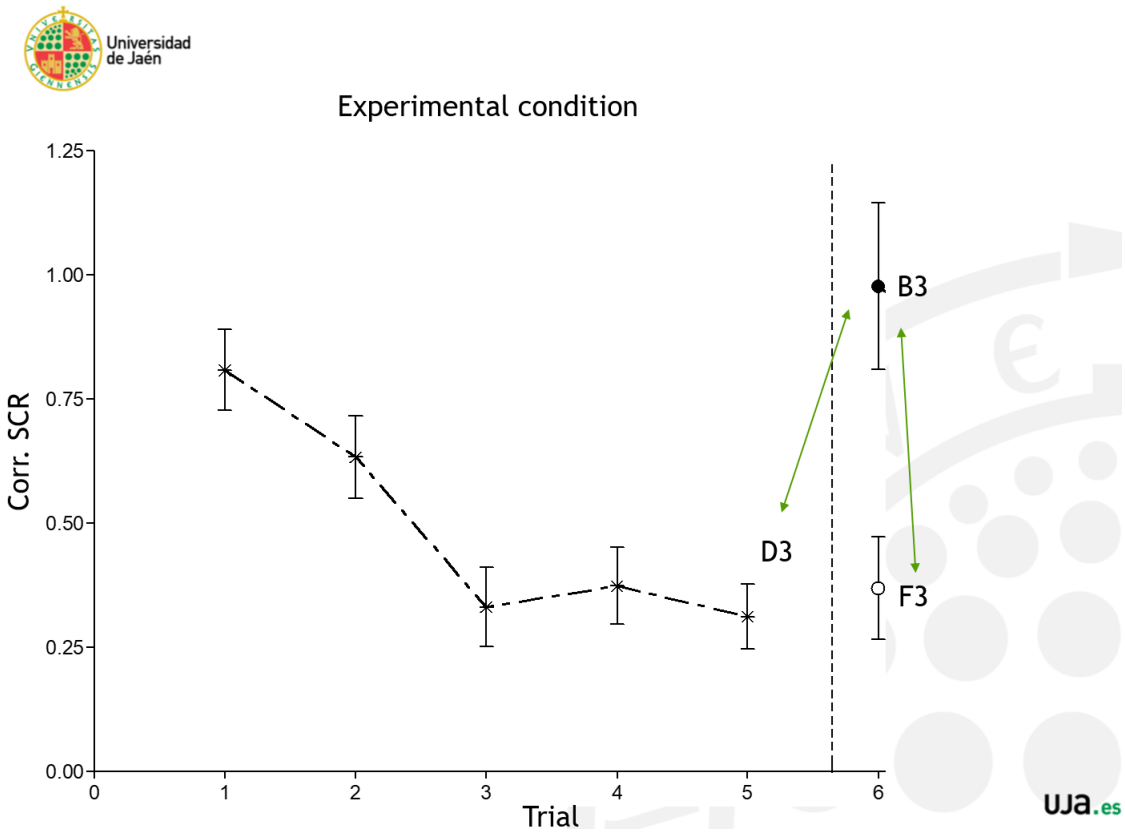

Figure 1.10: Results for non-control participants

this criterion. This is the average for the whole group: the effect for the large element is very clear, not for the smaller one. It was more difficult to get for the smaller one (1.10).

As for the control conditions, none of them produced this transformation effect, which basically tells you that both the C_{rel} and the C_{func} components, were important inobserving this effect. So basically this effect shows you how fear can change depending on the types of relations that you have learned, amongst all of those teams. And these are just a few samples of a growing literature on the derived transformation of fear and avoidance:

Avoidance:

- Bennett et al., 2015;
- Boldrin & Debert, 2020;
- Donati et al., 2019;

- Dymond et al., 2007, 2008, 2011, 2012, 2014;
- Ganderela et al., 2020;
- García-Guerrero et al., 2014;
- Luciano et al., 2013, 2014;
- Roche et al., 2008

Fear conditioning and extinction:

- Luciano et al., 2013;
- Vervoort et al., 2014.

You have lots of references there, and the results they provide are consistent with more recent research in the broader field of fear generalisation, which is a very important part of the experimental psychopathology literature. There's lots of research now on instructional effects on fear conditioning and generalisation. I'm just thinking: research by Gaëtan Mertens and Jan De Houwer showing that when you provide specific instructions, information about the stimuli in an aversive conditioning procedure, this might change dramatically the fear reactions that they show. So learning that a stimulus is not dangerous, or is dangerous, affects how it works, or how it produces fear reactions in a fear conditioning paradigm.

Obviously ,I limited myself to talking about fear and avoidance, but this is all early RFT research, but it's all part of a broader body of research on the derived or emergence of responses that are somehow clinically relevant or relevant in psychopathology. We have studies that have shown the transfer or transformation of mood: you induct a type of mood, a sad mood, or a happy mood for some stimulus in a network, and then you see how other stimuli in the network produce self-reports of the same type of mood; sexual arousal, consequential functions, the fact that a stimulus aversive or appetitive. Even contextual control of self efficacy expectations: learning that in the presence of

specific contextual cue, you will always fail a task and this generates a poor sense of self efficacy and how this is controlled by other stimuli in the same network.

In my view this body of research models experimentally how psychological suffering can become ubiquitous or omnipresent, and how our own behaviour, including private events, can become part of relational networks of increasing complexity. This is key in terms of –I'm just thinking– the very model of psychopathology of acceptance and commitment therapy, which is to a large extent determined by how you relate to your own private events, whether your own private events somehow function as aversive stimuli and you engage in very unproductive and adaptive attempts to avoid parts of your own behaviour.

The connection with private events is not just theoretical. There is this study in 1992 (DeGrandpre et al., 1992) that shows how the effects of a drug —and by the effects of a drug I mean the subjective effects of a drug, how the person feels after the drug has been used— can function as a conditional stimulus in conditional discrimination training and also enter stimulus equivalence classes.

So how a very specific private event produced by the use of a drug can become an element in a relational network of coordination with other exteroceptive visual stimuli. I will just very briefly– this study is a human behavioural pharmacology study. Participants were administered with pills. They were physically identical. They didn't know that, in some occasions the pills were triazolam, a benzodiazepine which produced relaxing, sedative-like effects; and, some other times, it was just placebo. The build was acting for like 90 minutes, and then participants were trained to choose different visual stimuli on a screen, and they got reinforcement for that. So they learned to choose B1 upon the effects of triazolam; B2 upon the effects of placebo. This is what we call a drug discrimination procedure. This is used with animals. You can train animals to choose different levers, or to press a lever under the control of two different contextual cues, depending on the state produced by a drug. There were also

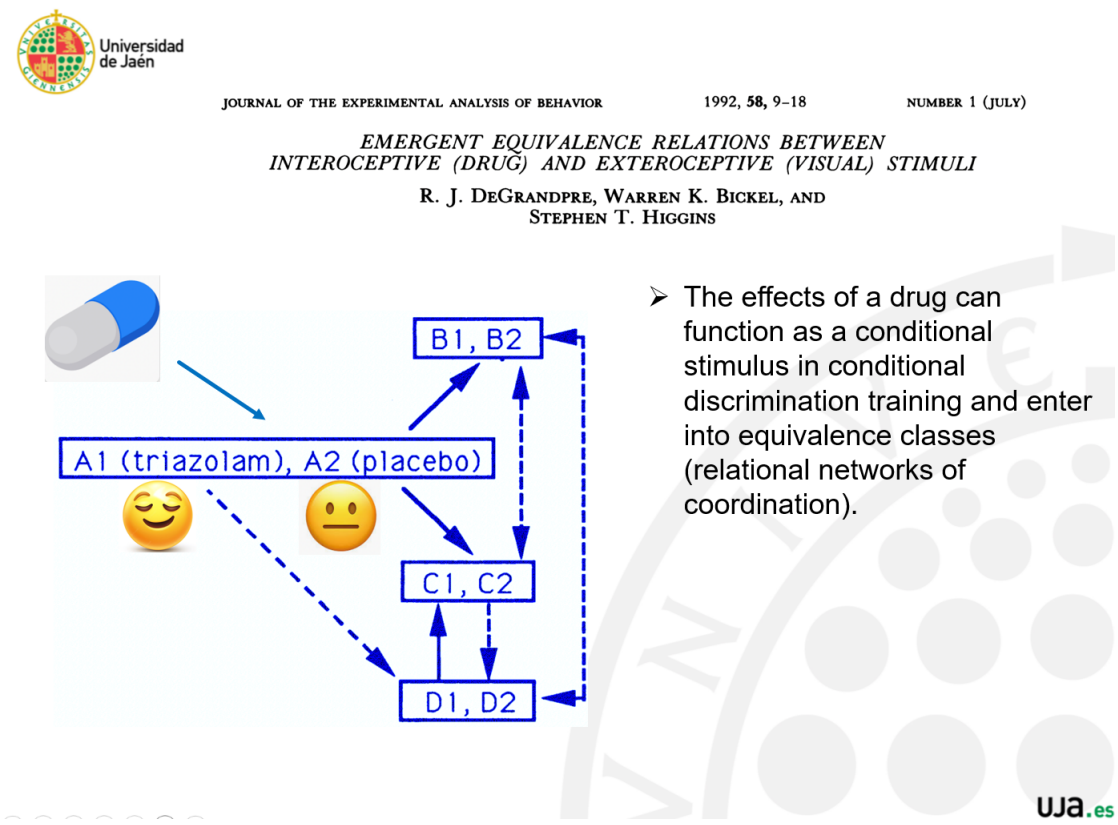

Figure 1.11: Equivalence relations on drugs

trained to select C1 upon the effects of A1, C2 upon the effects of placebo, and then further equivalence relations were established with the D elements between C and D elements. What you have is that, in transfer tests, participants were given the drugs and, depending on the effect of the drug, they would choose stimuli that had never been presented to them. For instance, the D elements.

We have more research that somehow involves the discrimination of the participant's behaviour and how it acquires, somehow, stimulus properties. This is a study by Dermot and Simon Dymond; one of the early demonstrations of multiple stimulus relations in a network (Dymond & Barnes, 1995). Participants learned a relatively complex relational network with different relations of sameness and comparison. So, A1 was the same as B1 and C1, but it was more than B2 and less than C2. And they were trained to emit a particular operant and response to on a

keyboard to key press once in the presence of the B1 stimulus; and they also learned that there were other schedules of reinforcement available: so, with novel stimuli, not involved here in this relational network, they learn to press– to emit no key press or two key presses. And when they were presented with the C1, C2, and B2 stimuli, basically they showed a pattern of operant behaviour that was consistent with the relational network: so they responded more to the C2 element, which was large, symbolically larger than, and they responded less to the B element. So, the participants behaviour could be discriminated and entered into this relational network.

In relation to private events, there's specific type of framing which is deictic framing. Deictic frames specify relations from the perspective of the speaker. So, basically, the relationship between the individual and other events serves as the constant condition upon which these relational frames are based. When children respond to questions like: What are you doing now? What am I doing? What are you doing there? The physical environment may be different every time, but the relational properties of the perspective "I *versus* you", "here *versus* there", and "now *versus* then" remain constant. And the development of this deictic relational responding allows the learner to respond appropriately to questions about their own behaviour in relation to the behaviour of others. It allows the learner to develop a sense of their own, of their own perspective, and that of other people. And from the RFT point of view, the establishment of date framing is key for the development of perspective taking abilities such as theory of mind.

So all of the research I have mentioned has to do with relatively simple relational networks, and simple relational frames. The idea in relational frame theory is –even though the research I have mentioned, I think, it has important implications for psychopathology– the idea is that RFT aims at providing a full behaviour analytic account of complex human behaviour of language and cognition, and this would include the more complex forms of language and cognition. So increasing levels of complexity need to

be addressed, like relational networking: how different frames are combined into a network, and this would constitute a good model of how rule-governed behaviour works, how rules produce their effect and control behaviour; their relating of relations, analogy and metaphor; and relating relational networks: relating different complex relational networks, which would be an example of how we can abstract a common theme in different complex narratives. So, in relational networking, we are addressing the combination of different relational frames into increasingly complex relational networks. The idea is that even a simple rule involves the combination of multiple types of relational frames: coordination, temporal, conditional, combining ways that transform the specific behavioural functions of those stimuli, and may provide those stimuli with the capacity to control specific responses. For instance, a simple rule like: "if it's sunny, then wear a cap to avoid the sunstroke", something that I have to remember myself very often, you have coordination relations — e.g., sunny, cap, or sunstroke: they all correspond to objects or events. So, there's coordination relations. You also have conditional or temporal relation: If condition A is there, then this will happen. So, if it's sunny, there will be a sunstroke. If it's sunny, but you wear a cap, there will not be sunstroke. OK, so the idea is: once you learn to combine these relational frames into more complex relational networks –basically, a rule is a relational network where the functions of the stimulus specified in the rule can change and end up controlling behaviour. So, if I get this rule, "if it's sunny then wear a cap to avoid the sunstroke", I might just go out and see if it's sunny or not, and this will have an effect on my behaviour: I will just change my behaviour upon the presence of that object. So, basically, the rule has transformed the functions of several actual elements in my environment according to the relations specified in the relational network.

Now, obviously, an analysis of rules and rule-following is –I think– it's key to any form of psychopathology. So if you think of different approaches to clinical psychology and psychopatho-

logy, like CBT or ACT, they both rely heavily on rules and rule-following. So, from the point of viewof CBT, psychological suffering results from beliefs, thoughts, cognitive schemas, and their emotional over behavioural effects, and the interventions should be addressed to disputing, modifying, and restructuring those rules, and fostering more adaptive rules, so it's the idea that I should have more adequate, adaptive, realistic, or rational beliefs.

As a different approach from CBT, acceptance and commitment therapy (ACT) posited that psychological suffering results from excessive reliance on rule following. Basically, I pay too much attention to my, let's say, cognitions, and this prevents contact with the direct environmental contingencies, and interventions are aimed at undermining this excessive form of verbal regulation. So understanding how rules work in terms of relational networks is important. So, the key, if I have these instruction or rules– e.g., the key for a good presentation is not to be nervous, and I'm here sitting and I'm not in part of my own behaviour that I have identified in my history as being nervous, this will not be very coherent with the way I want to be in a presentation. "If I'm nervous, I will be a failure" — you will possibly be motivated to try to avoid that part of your own behaviour that you are discriminating as "being nervous".

Relating relations and networks. Research has shown that it's possible to establish and derive relations between relations just like they were stimuli, and this constitutes an RFT model for analogy and metaphor. Both Dermot and Ian Stewart have worked extensively on this. I will go rapidly over an example of one of those experiments (Stewart et al., 2002) where you train different equivalence classes and basically what you test is not single stimuli but compound stimuli that are related either as equivalent or non-equivalent. Participants discriminate the relation between the two stimuli and the complex, and are able to select the comparison, the comparison complex, that shows the same relation that the sample has. And this constitutes a model of how analogy works. If I tell you that (this is a very strange ana-

logy, I'm worrying): "anhedonia is to depression like dysgeusia is to COVID". let's say– I have my 8 year old child who's learning a lot about COVID at school (dysgeusia is, by the way, when you lose the sense of taste) and she knows this because here she has had to learn about a lot of things about COVID, but she doesn't know a lot about depression; I mean, she's 8 years old. So, she heard this word "anhedonia" and she doesn't know what this is about. And I tell her: "OK, you know a lot about COVID; you know what dysgeusia is like; OK, what if I tell you that anhedonia is to depression like dysgeusia is to COVID." Okay, what happens here? You re-establishing relations between these two sets of stimuli. "*Anhedonia is to*" would be the relational cue that is signalling that there is a relation between depression and anhedonia, and it's "*like*". So there's a relation: it is coordinated, it's just the same as the relation that there is between dysgeusia and COVID. So if my child knows that dysgeusia is part of COVID, that it is a symptom, or even that it's definitely a feature of COVID, she might derive that anhedonia is part of depression. It is a symptom of depression. It is a definitory feature of depression, even though she has no idea W=what depression or anhedonia are. Even, if she knows more, she might even establish more complex networks. For instance, if she knows that dysgeusia is about losing the sense of taste (i.e., everything tastes the same, you lose the pleasure of eating, you lose interest in cooking, perhaps; and that would be a lot to ask her for an eight-year old, but anyway), she might derive that anhedonia is like losing a sense of feeling: everything feels the same, you lose pleasure of activities, you lose interest in life.

Now, this is relating relations. You can also relate relational networks, or more complex relational networks. And I've just put this example here, but this would be very similar to what we have before, but obviously you're not relating very simple relations, but two complex relational networks. So if I tell you that "depression is like gradually losing your sense of taste, you don't know why, but everything you eat taste like Mashed potato and you never feel satisfied. And when everything tastes like

that, you keep eating because you must eat to live, but the effort in preparing meals seems pointless and provides no reward; you know eating will not satisfy you, so you stop caring about cooking, you stop using the ingredients you still like, and eventually ask yourself why keep eating at all if you're not enjoying it; you're still hungry and tired of the same plain flavour, and you don't know if you'll ever enjoy food again." So you're getting a lot of information about depression and how depression works. Based on all of the information in a complex network you get about something you might be much more familiar with, which is having this sensation that you've lost your sense of taste and how that applies to your life more generally.

A recent conceptual development in RFT, an update of the theory, it has been much more explicit in terms of the relevance of the different levels of relational behaviour development. So, I have just mentioned: relational framing would be mutual entailing, and relational and combinatorial entailing. But then you have relational networks, relating relations, and relating relational networks. The idea that this forms of arbitrary relational responding interact dynamically along four different dimensions, the dimensions of coherence, complexity, derivation and flexibility. Coherence has to do with the extent to which a relation you derive is consistent with your priorly derived relations. So if I learn that "A is more than B", then "B is less than A" will be coherent. It would be very strange to derive, or to receive reinforcement for deriving that "B is more than A". This is not consistent with my prior learning, with my history of learning the relational. Complexity refers to the amount of relations that are entailing relational framing. For instance, combinatorial entailment is more complex in a comparison frame than in a coordination frame, because in a coordination frame both mutually entailed relations are the same, while in a comparison frame they are different. If "A is *more* than B", then the entailed relation is different: "B is *less* than A". Derivation refers to the level of practice of a particular form of direct relational responding. So the first time the relational responding is emitted, it's very

high in derivation; so it is the first time this response occurs. But once it occurs, it obviously has its own direct history, which might make it much more automatic, which might make it enter into direct reinforcement contingencies. Finally, flexibility, which refers to the extent to which derived relational responding can change upon changes in contextual cues.

I just wanted to mention: this is just an experiment conducted in 2010 (Luciano et al., 2010) and it just to illustrate how relational theory concepts can be applied to explanation of relevant clinical phenomena. So, basically, in this experiment, discomfort participants had to do a task and they were presented with aversive stimulation in the form of a very abrasive noise. The way you frame discomfort, as either in a relation of inclusion with a valued activity or as in a relation of opposition with the value activity like a barrier, changed how you perceive discomfort to be. Participants who learned that discomfort was a barrier, something they could not– they had to get rid of before they could engage in a valued activity, evaluated the task and the abrasive sounds as much more distressing than participants who learned that discomfort could be part of the task, that you could engage in. This is much more complex, but obviously we don't have time. And this form of analysis has led even to very recent conceptualisations of psychopathology in rather complex terms, relational terms, like framing one's private events in coordination with one's behaviour: so I behave in coordination with my private events, mostly to avoid them. Or framing one's private events,as in hierarchy with one's behaviour: so my private events are just contained, let's say, or hierarchically "*less than*" me, than the perspective of "*I*" and all of this under the control of an overarching motivation or meaningful direction, which would be what we call *values* in therapy.

1.2 Dr McElroy, “In search of disorders: a network approach to mental ill-health”

[...] Talking about things like questionnaires, diagnostic interviews, that's– when I refer to measurement, that's really what I'm talking about. And measurement lies at the heart of all science, not just not just psychology. Before we can truly understand the aetiology of a phenomenon such as mental ill health, we have to be able to first of all define it, operationalize it and to measure it accurately. So really my whole talk today is about trying to answer one very very simple question and that's that question is what kinds of things are mental health problems? Seems like a very simple question.

When we tried to define, say, psychiatric disorders, the same types of things tend to come up. You know, we we talk about maybe experiences emotions, certain behaviours and these things often result in distress, danger maybe, to the individual themselves or other people. Dysfunction, these types of things. But these experiences and emotions and behaviours they they co-occur together. And if this co-occurrence is is the keyword and the idea of a psychiatric disorder is to essentially classify these co-occurrences. Disorders, or rather, diagnosis. What are they? They're language. They quickly sum up these various experiences, behaviours, emotions in a kind of consistent manner. And this is something obviously, we're all psychologists here. We're all familiar that this is something that we do quite naturally, as human beings.

You know, I make cognitive psychologists will tell you that humans are inherently lazy. We take as many cognitive shortcuts as possible. Things like schemas or essentially cognitive shortcuts to summarise lots of co-occurring information so we can process it more quickly. And that's essentially what we do with diagnosis. Um, and we've been attempting to do this with psychiatric phenomena for a very, very long time to develop classification sys-

tems to accurately describe them. If we go all the way back to Ancient Greece. Hypocrites. One of the first to suggest some sort of classification system proposing that mental health problems were due to biological chemical imbalances, fluids within the bodies, or humours. Emil Kraepelin, the the 19th century German psychiatrist, he's often referred to as the father of psychiatric diagnosis. He proposed the distinction between what is essentially schizophrenia and bipolar disorder. That these are two kind of unique disorders that people experience have unique causes, biological mechanisms, symptom expressions.

And Kraepelin's way of thinking has really influenced our most common approaches of conceptualising and measuring mental ill-health as a series of diagnostic categories, such as those found in the dominant psychiatric manuals. Things like the DSM diagnostic and statistical manual of mental disorders, and the ICD 11. This is the type of language that most people, whether you're involved in mental health research or practise or just the general public, this is the type of language we use when we're describing mental health problems. Anything the way we think about mental health problems, you know, describing them as these things that people either do or do not have with each disorder reflecting a unique pattern of symptoms, proposed to have a kind of unique cause, different treatment outcomes and things like that. But few people stopped to ask questions such as what are these things? What are they really? And more importantly, how good are these classification systems? So let's have a think about about these ideas and a little bit more depth back to our original question. What kinds of things are mental disorders? Why do certain symptoms co-occur within individuals in a particular recognisable pattern to answer?

That question we have to think actually about categories more broadly, different types of categories, categories and classification systems can emerge for different reasons. Or in other words, there are different types of of categories, so much of this stuff that I'm gonna be talking about. Um, if anybody's interested in it, I would point to this paper by by Ken Kendler, one of my probably

favourite papers ever really (Kendler et al., 2011). You know, this idea of what exactly is a is a mental disorder. So the first type of category I'm going to talk about and Kendler mentioned, this is essentialist kinds. So an essentialist kind is a category that exists naturally in nature, whether or not we are aware of it or whether or not we assign a categorization to it. So let's think about something like maybe the periodic table. The element of gold exists whether or not we're aware of it. You know, it's an atom with 79 protons. And anything that any atom that has 79 protons is gold. Any atom that has more or less is not gold. It's a very defined. It exists in nature. If we kind of scale this up, if we look at 2 bricks of gold, if they're the same kind of dimensions, we would expect the same property, same melting point, same malleability colour. And things like that. So you know these things, they truly in essence exist, and this way of thinking has inspired a lot of research and classification, particularly in kind of medical science. Essentially, assuming that certain diseases exist.

An essentialist kind is a category that exists naturally in nature, whether or not we are aware of it, or whether or not we assign a categorization to it.

Because there may be a single causal agent that causes a disease, and that disease is expressed or visible through these different symptoms. Now, this works well for *some*, but obviously not *all* medical conditions. A lot of medical conditions are very, very complex. But for the sake of metaphor, if we look at something like a viral infection, say we're not long out of the COVID pandemic. What is it? It's a viral agent that enters the body. It affects the lungs. So it's causing this disease within the lungs. This is expressed. Without doing some lab tests, you know, how do we at least think somebody has COVID? They've maybe shortness of breath, coughing, temperature, things like that. If we look at some maybe, maybe a cleaner example, I guess maybe some monogenetic diseases. So things like sickle cell anaemia linked to a particular gene variant that causes these health problems. So if if we were to take this logic, and this has inspired a lot of things like the DSM, which obviously very medically driven, if mental health problems were essentialist kinds, they would operate as follows. Some risk factor, be it external or internal, maybe some sort of biological predisposition, causes a specific mental health

disorder or mental disease. Presumably, this disease has some sort of biological basis. You know, some some abnormality in the brain, something like that. And this causes an individual to display a range of observable characteristics or symptoms, so this could be, if we think about something like depression, it could be low mood, guilt,leep difficulties. So, under this way of thinking, the only the only way that these three symptoms that I've just talked about co-occur to greater-than-chance levels within an individual is because of this underlying disease that's been caused by something. You know, the nice and simple explanation for things. And if you treat this underlying disease, then in theory these symptoms they should stop co-occurring.

Like I said, this way of thinking has influenced our diagnostic manuals. After the publication of the DSM 3, which is in the 1980s where a lot of our most widely discussed mental health problems kind of a marriage from, It was some quite bold claims were made that we had kind of cracked the code in some way; that we've sort of accurately defined all forms of mental health problems. This particular quote, I think it's quite interesting. Franklin: "Psychiatry today stands on the threshold of becoming an exact science that's as precise and quantifiable as molecular genetics, head lice and error of psychic engineering and the development of specialised and drugs and therapies to heal sick minds." So basically making the claim okay we've cracked the code. We know what each individual disease mental disease looks like. No, it's only a matter of time before we find unique genes, unique biological explanations will develop, all these unique treatments for each individual disorder and we'll make tremendous progress.vAs we all know, in the decades since then, that progress hasn't really emerged for most common mental health problems. There are no reliable biological markers. You can't scan somebody's brain, somebody who has major depression and somebody who doesn't have major depression. You might not see any differences there. 0:10:31.940 –> 0:10:32.460

Um. 0:10:33.460 –> 0:10:54.870

Genetic research. Again, not– if we think back to the sngle-

cell anaemia, there’s no real for most common mental health problems. We don’t see a similar pattern where we haven’t found a gene for major depression, a gene for a single gene for schizophrenia, a single gene for social phobia. Any genetic effects that we have found are quite polygenetic, so lots of different genes having very, very small effects on lots of different psychiatric categories. There’s also the issue of comorbidity in the sense –and by comorbidity I mean people having or meeting the diagnostic criteria for more than one disorder at any one time — if we if we think back to what an essentialist kind is, there’s supposed to be very defined boundaries between categories. Like I said, Gold has 79 protons; it’s gold. If it doesn’t have 79 protons, it’s not gold — whereas comorbidity is the rule rather than the exception. Anybody who meets the classification for any psychiatric disorder, there’s a 50% chance they would also meet the classification or the criteria for a second disorder. If you meet the criteria for two, you’ve got a 50% chance of meeting the criteria for a third, and so on. So, it suggests our boundaries are very, very imperfect.

And because there’s no clear and obvious. Causes for a lot of our our mental health problems, we find ourselves in these situations where we’ve got these quite problematic and somewhat circular logic. So here’s just an example of– if you’re prescribed to the strict old-school psychiatric orthodoxy, you could find two either researchers or clinicians having this conversation. One asks the other: “why is this man hallucinating? Well, the answer to that’s obvious: it is because they have schizophrenia. Okay, well, why do they have schizophrenia? Well, it’s because they’re hallucinating.” And we’re finding when we’re not building causes into our description of things we find ourselves in these situations.

So, it looks like thinking about psychiatric disorders as an essentialist kind isn’t, you know, they they don’t seem to meet the criteria. Basically, let’s see what the kind of the some of the most influential bodies say about this. If we look at the American Psychiatric Association, this is a little bit of text from the I think it’s

one of the introductory chapters are forwards in the DSM. The most recent addition, DSM 5, and they stated that the symptoms contained in the respective diagnostic criteria sets do not constitute comprehensive definitions of underlying disorders. Rather, they are intended to summarise a characteristic syndromes of signs and symptoms that point to an underlying disorder with a characteristic developmental history, biological and environmental risk factors, neuropsychological and physiological correlates, and typical clinical course.

Now I've done this talk or variants of this talks. Talk many times. I must have read that particular paragraph about 50 times and I still don't really know what they're saying there. They seem to be saying Disorders. They're kind of these essentialist kinds. They might be there were not 100% sure. To me, it's almost like a bit of a get out of gaol free not wanting to commit kind of argument. So let's look at the not– so essentialist kinds don't look like, they doesn't look like disorders meet that criteria. Let's look at another type of categorization. Practical canes. So these are classification systems that don't necessarily have to exist in nature. Rather we as humans create them, and the idea is that they serve a useful purpose. So let's look at an example of a practical kind. So say I'm an avid reader. I've built up over many years a large library of books. I want to go back and read my favourites, but I've got so many it's difficult. I wanna create some classification system to help me organise things to help me access the books I want. There's different ways you could go about this, you could go with the tried and tested kind of alphabetical, maybe based on author. You could devise one of these incredibly in every university I've ever been in these incredibly complicated library systems that to this day still can never work out and have to ask somebody. I want to find this book. Maybe you're sort of very free spirited individual and decides sort of to hell with logic and just going to organise things by kind of colour code of the cover. None of these classifications are natural. None of them are necessarily right. Each have maybe their own strengths and weaknesses apart from apart from maybe this one obviously,

but I think you could agree that any one of these classification systems is better than absolutely no classification system at all.

So in many ways, our diagnostic systems appear to look like practical kinds. Most disorders we commonly research and discuss things like major depressive disorder for manuals like like the DSM and ICD, these disorders have essentially been voted into existed existence. You know, expert panels getting very experienced clinicians come together every decade, couple of decades and decide based on their own experiences, their own knowledge of the area, their own epidemiological research, even what do we think these disorders actually look like? A Rep so. If we, if we look at something like major depressive disorder, the DSM criteria for that. And you know, for for a for a two week period somebody has to have one symptom of either feeling sad or low mood loss of interest in their usual activities. And then there's some additional symptoms they have to have at least five of. So things like changes in appetite, fatigue, worthlessness, guilt, all of these things. So. And then there's some other kind of things you have to rule out certain other things. So these are very detailed. Rules to kind of meet the day diagnostic criteria for these things, but again there– you know the term DSM diagnostic and statistical manual is a is a little bit misleading you know, because not a lot of statistics have have informed these, at least not traditionally. We're getting better at it, but not not traditionally. But again, if these are a practical kind, these things don't have to exist necessarily in nature. If there are practical kind of, there are some use to us, then maybe there's justification for that. And there are many ways that these kind of this kind of practical kind approach has been beneficial. It's standardised things allowed us, you know, consistency and comparability, maybe across countries across time by having an accurate description of, I guess, illness were better placed to at least investigate it if we haven't already discovered the etiological causes. And I guess by you know, the rationale is that by knowing what specific disorders look like, we might be better placed to to identify the most appropriate treatment.

So again, if we look at go back to the forward of the DSM. There's another short passage to the can of argues that no, actually what we're dealing with here are practical kinds. The diagnosis of a mental disorder should have clinical utility. It should help clinicians to determine prognosis, treatment plans and potential treatment outcomes for their patients. So exactly what I was just saying, that's the whole rationale. With with this approach. The only problem is is that the categories that we use aren't very good, so they're kind of not meeting the main criteria that they're supposed to. So this is just an example of some of the field trials for the most recent edition of the DSM. And looking at things like basic interrater reliability, if you have two clinicians assessing the same individual, how often will they? You know, settle on the same the same diagnosis. And the overall the reliability was deemed to be to range from poor to fair depending on the particular type of diagnosis we're dealing with. So it suggests that our current system not terribly reliable if we think about things like our treatments, the idea was okay, we have all these different disorders. So we can give the best treatment freaks disorders, but If we look at the treatments that are available to us.

Think about medication. I mean, there's there's three types of medications. Really. There's antipsychotics that'll help us policing nations, things like that lithium that will regulate mood and antidepressants, which will have some effect or treat basically everything else to some degree. Or disorders as well. You know they're there are few. I mean there are exceptions, but there are few disorder specific therapies. So if we think about things like CBT, the principles of CBT can be used to treat lots of different. Lots and lots of different disorders, so again we can see we're not, we're not really meeting the criteria for proper practical kinds either, so again, if we go back to the the forward of the DSM. It's it's kind of saying it's it positions, psychiatric disorders as somewhere between perhaps essentialist kinds and and practical kinds. But we can see from the evidence that we're. The diagnostic disorder approach doesn't really excels either one of

these types of categories.

So what are the alternatives? There are more and more alternative classifications being proposed. A popular one that's getting a lot of traction over the last maybe two or three decades. Is the the hierarchical taxonomy of psychopathology also known as high top? And this is basically a quantitative alternative to traditional diagnostic kind of voting disorders into existence. And what this approach does is. It uses data from either surveys or interviews of of thousands of participants. This is what it's based on. People are asked to report different symptoms. The high top approach then applies statistical techniques like like, say, factor analysis to identify groups of problems that are most likely to to occur. So if you ask about different symptoms of Depression, anxiety, anti social behaviour, oppositional defiant disorder, some psychotic type symptoms and apply these kind of data reduction techniques. What you'll find is that a lot of these disorders kind of gripped together. So rather than hundreds of specific diagnosis or diagnostic constructs, the idea is well, maybe we should be looking at these much broader. Let's broaden the conceptualizations of the types of experiences people have these dimensions. They're proposed to be continuous rather than kind of strict categories, not a case of you either. You know you meet the criteria. If you're depression, you have depression or you don't have depression. These are proposed to be these kind of naturally occurring continue. Everybody probably falls somewhere, for instance. Factor analytic studies have shown that Symptoms characteristic of of disorders such as depression, anxiety, phobia, some OCD. These tend to to group quite strongly together. This factor is often called the the internalising factor are kind of emotional problems factor, and it's proposed that everybody kind of falls somewhere on this continuum. Maybe what we traditionally considered as something like depression is people who are maybe further down that the extreme end of the continuum.

So what are the the scientific benefits to this approach Again, a lot of empirical studies. As of 2021, there were there were over 500 empirical studies, again, most using variations of factor ana-

lysis supporting the. The structural validity of this approach, I guess. Studies have found that, you know, working at the broad dimension level is more effective at predicting treatment outcomes. Also, again back to genetic studies. I already mentioned there's this more kind of Polygenetic effect impacting multiple disorders. So when you're dealing with these broader dimensions, you might see stronger, stronger effects there. Also, things like more reliability and validity. Statistical ranges can be developed so we know it's alright dealing with continue, but we know that in clinical practise unfortunately categorical decisions are unavoidable most day-to-day clinical practises categorical in nature. Does this person suffering enough to warrant treatment? If so, what type of treatment do they have? Are we going to do psychotherapy, medication, some combination of both? But rather than basing. You know, there's got to be a cut off somewhere, I guess, but rather than basing them on these kind of arbitrary DSM type rules. The empirical data in the likes of high top can be used to maybe derive more quantitative cutoffs that should in theory be more reliable. Although they are empirically driven, we do, however, run into many of the same problems. Actually, that we see at the lower disorder level. So a tonne of research, again using factor analytic analytic models has has modelled, you know survey data like this in large samples and when. When doing this, when looking at these at these broad dimensions, what has consistently been found is that the dimensions themselves, even though they're quite, I guess, conceptually distinct. So if you look at something like internalising the more emotional problems externalising, the more anti social. Behaviour substances, those types of difficulties, even though qualitatively they're quite distinct. If you look at the data, the correlations between these actual dimensions are remarkably high. So on average they look across a range of different studies. You tend to find a correlation, but point .6. So in some ways we have the same issue of coal morbidity. We've just kind of shifted it up 1 theoretical level instead of Co occurrence of psychiatric disorders. Now we're looking at correlations between dimensions. This is left hate help researchers. I I've done some research in this

myself to propose. An even higher order factors E factor general factor of psychopathology, a bit like a mental health equivalent to G general intelligence. Basically, I kind of super ordinate factor that accounts for all Co occurrence of psychiatric symptoms and basically explains everything. Statistically, *P* is is fantastic. It works. You know you you fit your your your data to these models that fits terribly well. Very, very well. Explains a lot of covariation. But the question is again, well, what does this actually mean and what's the practical utility of something like this? Can we? How can this be used to inform maybe day-to-day? Clinical decisions you you bring people in and not assess them for every single possible cycle. Pathological symptoms under that you know it's not terribly Practical. And if we're looking at, you know. I'm covering 8 theology. You know, we're really we're zoomed out essentially as far as we can go here. So we've got almost no, no specificity at all.

So that's really where the network approach comes in. And in many ways the the network approach is in some ways the exact opposite of the high top approach. So rather than reducing symptoms and disorders down to the kind of lowest common denominator or the overall factor go the opposite direction. Let's zoom in and try and understand mental health problems at A at a much more granular level, as specific as we can get so in other words, we're sort of embracing the the complexity of mental illness. So let's — and this is where I think we start to see maybe some of the overlap with what we were, what Miguel was talking about this morning — So let's explore this idea. And a little bit more depth. So on the left we had the latent disorder view of a of a mental health problem, let's say depression. That that we've just discussed again, to recap, you've got your kind of causal agent or agents which leads to the development of this disease, which is expressed as this form of Symptoms the network approach on the right here in some ways, cuts out the middleman. It cuts out this idea of They're being a disorder at all and focuses purely on the symptoms themselves and and how they interact as a complex system, so Suggest that let's say, OK,

we've got a a trigger here again the trigger could be anything, it could be biological in nature, psychological could be some sort of environmental or social factor. It triggers these symptoms within an individual. Which in turn activated additional simple. So say something like you have a stressful event in your daily life. This triggers a degree of irritability within you. If you spend most of the day kind of irritable and wound up, perhaps that could have a knock on effect on your ability to sleep well that night. If you have a bad night's sleep. How are you going to feel the next day? Maybe higher levels of fatigue, loss of motivation, lower mood, things like that. So these symptoms could potentially initiate a kind of cascade of effects that feed into and reinforce one another. And if this process continues if this, if this psychological network or system is continually reinforced and maintained, maybe the symptoms reinforcing themselves, reinforcing other symptoms, whether other risk factors feed into the network, if this goes on long enough, then potentially these systems can become kind of entrenched to the degree that if you remove the original stressors and causal. Factors that This behavioural pattern is Co occurrence of symptoms can can continue to sort of self perpetuate. So in other words, symptoms aren't just passive indicators of an underlying disorders, the symptoms themselves. Are the disorder, in other words, we're dealing with a kind of part hole relationship here rather than as an essentialist kind. That's the. That's the network approach in general. That's always I find the hardest slides to kind of get through with this. This chat does everybody. Everybody. What's my here? Brilliant.

And So what are the advantages of thinking about mental health problems in this way? Well, it offers a pretty intuitive explanation of comorbidity between disorders. So rather than saying okay, this is disease A that somebody has. This is disease B. That's completely unrelated. But they also happen to have. Why do they have these both the same time? Well, the network approach offers a it embraces the complexity and offers an intuitive explanation. And so under this interpretation, we would think of what we may be traditionally thought of as disorders, as

these kind of little clusters of symptoms that are that are particularly. Highly related to one another, feeding into and reinforcing with one another. But that doesn't rule out the fact that certain symptoms can still have have. Other Connexions may be slightly weaker, but still meaningful Connexions kind of across these different clusters. These types of what we will call bridge symptoms or Connexions between Disorder clusters. So that's way thinking about mental health problems. It's certainly not new. In in some ways. Least from the research I'm familiar with. It's it's the the kind of observational field or or epidemiological field is kind of catching up to other other disciplines. You know, a lot of this sounds like what GAIL was talking about this morning. If we look at some of the treatments that are out there for mental health problems.

You know, CBT has long been based on identifying these kind of maladaptive feedback loops and trying to to to break them. So in some ways this is maybe we've got things the wrong way around where the research in my area anyway is catching up to the practise when it should be the other way around. So before I I continue Let's maybe take a bit of a step back and think about networks more broadly. So networks meaning using Graphs. Essentially to explain complex relationship between between entities — Again, not not a new concept at all. Used in lots of different fields. Bringing it to the field of psychiatric epidemiology. And this was spearheaded by and continues to be driven largely by a group in the University of Amsterdam originally led by Professor Denny Borsboom and Angelique Cramer. Other notable names, if anybody has ever read any of this stuff, you'll see them same names coming up again, Eiko Fried. Who is a a big name in this area and and kind of a bit of a an academic celebrity on Twitter, Sasha Epskamp and people like that. So they have really they've really driven a lot of this stuff.

But before I talk about the network approach in more detail, I thought I would just recap some kind of key terms and concept and networks before we before we continue. Networks By donor centrally to two key features, regardless of whether

you're dealing with mental health networks or networks in the different discipline, we're essentially talking about two things, and that's nodes and edges. So we're Nord can be practically anything really. It's an entity, something we want to measure essentially, and it's typically represented as a point in space. An edges referred to lines between the nodes that indicate the presence of some sort of connexion or relationship between the entities in question. Again, I'll show some examples of what these entities could be, but I I just wanna clarify the the kind of the key terms first, so edges. Can I have can have different features? They can be weighted or unweighted so an unweighted network would be like would look like this. So node one and node 2. And we know from this that there's some connexion between them. We don't know what that connexion is, but they're connected in some way whereas Node 2 and Node 3 here aren't connected at all. They can also be weighted so in this instance we've got a connexion between node one and node two, node one and node three, and I've denoted the strength of the relationship based on the thickness of the line. So in other words. These two pairs are related, but note one is more strongly related to node two than than it is to node 3. They can be positive or negative. Maybe that's not the correct terminology, but. I guess you can encode information that's that indicates how. How certain nodes are related. So in other words, if one node for instance increases, does another node increase in in parallel? Or you know if there's a kind of positive connexion, there was a negative connexion as one node increases as you intervene as you do something to to one node, the opposite happens to another node. So we can have different directions in effect. And again, nodes can be directed or undirected. So on the left here, we've got an undirected network where where these different elements we know they're related in some way, but we don't know for instance, is node one influencing node two, is node 2 influencing node one maybe depending on the network, it might not be possible, there might just be a relationship there, they might not be directly influencing one another. We don't know what. There's no direction here, whereas here we've got a directed network where we know that

node one influences node two. Or in other words, there's node one increases. Node 2 increases, but the reverse is not necessarily true. In other words, Node 2 isn't influencing node one. And you can have any combination of those types of features in in your network. You could have a kind of completely undirected, unweighted network up to a much more complex directed weighted network. So again, a bit abstract, but there's when I go through some examples, these are important concepts to be aware of Another key concept of network science more broadly, is centrality.

Centrality is a very simple concept And basically a means of identifying what nodes lie at the heart of particular network. So if we look at this hypothetical network here, just eyeballing this graph, I can probably make the judgement that node number 3 it's right place right at the middle of the network. It's connected with lots of different things. It's easy to imagine that this note is more influential or more central than for instance, node 8, which is on the periphery of the network. It only has 11 connexion, so – and that's the idea of of sound trial day. So let's look at some examples of networks being used in other disciplines. So this is from a Journal of social influence. I think it's a sociology journal. So sociologists have used network analysis long before kind of mental health researchers. Here they were trying to map out. Um like a friendship network in a university? Fraternity. I think the idea was they wanted to identify who's kind of the who's king of the castle in this particular fraternity, and they also wanted to see, did smoking have a particular impact on the kind of structure of friendship. So basically every node in this network represents an individual living in this fraternity house. I think there was 37 of them. The colour coding reflects whether they were smokers or non-smokers and basically they were asked. They were given a list of every other. Member of the fraternity and ask are you friends with this particular person? Yes or no, and from those responses they were put into a network and we see something like this. So we see this kind of closely knit. I believe the Reds were smokers. See this kind of quite closely connected grip

of of kind of people who considered themselves friends. They were all smokers and suggesting that. You know this. This leads to the development, I guess, of friendships and bonds, maybe because you're standing outside smoking together all the time, something something like that again, I'm not a sociologist. I just thought this was an interesting example. Airports used in travel quite a lot. Aviation if we. If we think we've probably all heard the term that certain airports are real transport hubs, in other words, they receive and can kind of redirect flights from basically all over the world. So for instance, if you wanted to go from Belfast to, I don't know, somewhere in rural Asia, your first port of call might be to go from Belfast to somewhere like Amsterdam or Frankfort, and from there you get a connecting flight elsewhere, so the likes of Amsterdam airport gets just gets a lot of traffic and maybe sets really at the heart of a particular transport network. Used in Biological Sciences neurosciences quite a bit. I'm not gonna explain this example at all because it's far too complicated. I don't understand how people use network science to its full capacity in these disciplines because I'm not a neuroscientist, but broadly, it's about mapping regions of the brains and functionality and things like that. And this is my personal favourite example of applying network science. This is an example where some researchers want to determine who was the most influential character in a song of ice and fire. The series of books better known as Game of Thrones on TV. And what they did is they took the entire series of books. And had some algorithm or something to screen the books. And take every character and basically a connection or an age between 2 characters. Every node is a different character and an age indicates how often those two characters appeared within. I think it's something like 10 words of one another within the body of text. So the idea being that if one character is appearing next to other characters quite frequently, they're going to really lie at the heart of this, they're having the most interactions with other characters. So for instance. Tyrian had featured quite quite prominently and interacted with. You can see members of his own his own family. And some other other families in this fictional realm, so you can

start to see kind of who’s the most, I guess in this massive series of books, who could be considered, I guess the most influential character. That was that. That was published in Math horizon. So it was taken quite seriously that that bit of work. I just think it’s a really interesting example, so. That’s an overview of networks, quite broadly, how do we apply network principles to the study of mental health problems? There are various methods. Again, I’m going to mainly focus on the methods popularised and well developed and popularised by the Amsterdam group. And broadly referred to as as network psychometrics.

So the key difference between psychological networks as I would conceptualise them and traditional network analysis is that well, what are the what are the nodes and what are the edges represent so? Typically, in a psychological network or psychopathological network, the nodes represent specific symptoms, so your low mood anxiety, you know really at that granular symptom level and the edges represent the edges have to be estimated. They typically represent the correlation between symptoms, so most of these networks that are based on epidemiological data sets so And the clinical samples convenience samples, but again relatively large data sets for we’re talking typically in the hundreds, if not thousands of individuals completing survey questionnaires, completing diagnostic interviews, those types of things. That’s the type of data we use here. So typically they’re presented as partial correlations. So for instance, if we take, say, a symptom measure of of depression, something like the backs depression inventory, thousands of people completed out completed, we estimate the correlations or the partial correlations between all of the symptoms, people’s responses to the symptoms within the questionnaire. And we use that to estimate the network. That’s essentially what we’re doing here. Partial correlations. What’s the relationship between symptom and symptom B controlling for every other symptom in the network Typically we would apply some some kind of machine learning techniques, because if you’re dealing with a big network, you’re estimating a lot of parameters increases the likelihood of false positives and

things like that. There are some techniques that are typically used to try and deal with that things like lasso penalties. Which I'm not going to go into in in much detail. Well, you know, at their heart, these these networks we're talking about. Correlations with like most types of machine learning, I always think machine learning are very scary term sometimes, but usually it always boils down to correlations at the end of the day.

You might be asking why, if if all you're doing is correlating symptom data, what's what's? Is there anything really new here or what? You know, what types of research questions can we ask? What's at bringing to the table? I guess so I'm just going to quickly go through some examples of some work that I've done in the past that's with some very good colleagues to try and give examples of how the network approach can be used to answer questions relevant to the aetiology of mental health. So this is a paper I did a couple of years ago when I was a post doc at the University of Liverpool. And we had a very, very simple question here. We wanted to use network analysis to Test basically simply how distinct are our psychiatric disorders, particularly in in childhood and adolescence. How defined our diagnostic boundaries so. We partnered up with The child Outcomes Research consortium. It's a department within the the Anna Freud Centre in London. And what they do their their department, that kind of pulls together kind of routinely collected Mental health information. So, for instance, psychiatrist mental health professionals collect a lot of data on children present clinics. So what they do is they kind of hose that to use it for research purposes. So we got access to a phenomenal database really, of over there was just over 37,000 clinical cases where Children aged, I think they're up to about 16 completed the same standard psychometric instruments at the orchards, revised child and adolescent depressive Screener. What it is very simple. A 47 item questionnaire Can be divided into 7 subscales reflecting [neurotic] style disorders, so things like separation anxiety, social phobia, generalised anxiety disorder, panic disorder, obsessive compulsive disorder, low mood, major depression, that type of thing. So basically we what

we wanted to say is okay. Let’s feed all of this information into a network. If these disorders actually exist as essential as Keynes or practical Kane, well, not probably as essential as Keynes. What we would expect is a very clustered network. We would expect these kind of That’ll clusters of symptoms feeding into reinforcing one another, potentially, and maybe some kind of crossover. That would explain the Coolmore about, I think. What we actually found was this. Basically everything was connected to to everything, and all 47 symptoms. We we ran some additional Algorithms to try and pick out clusters. We found some evidence of clustering. In other words, certain nodes were likely to be more strongly connected to others. They formed these little patterns. But there’s ways of assessing kind of how refined or how strong that the general clustering is. We found it wasn’t particularly strong. We found they didn’t. They were relatively close to the DSM categories, but they weren’t perfect. We had this quite strong kind of generalised anxiety factor or cluster that was kind of seemed to be seen to be sucking up a lot of the symptoms I guess. So I mean the take home message again, we were using a relatively complicated technique here to answer a very, very simple question and the answer was, well, How refined or defined our diagnostic boundaries? This makes it look like you know they’re not terribly defined. They’re quite fuzzy boundaries. Dealing with these very distinct specific disorders could be could be considered maybe a little bit arbitrary. That’s just one example, other maybe more simple questions, so here is a study we were looking at Networks as a means to explain the comorbidity between depression and anxiety again in childhood. So this was some community data, not as not as large as 37,000 cases. I think we had about 1100 kids, a general population survey and there were a couple of things we wanted To lock out here, first of all is you know again do depression and anxiety form distinct meaningful Clusters We didn’t find much evidence of that We also wanted to look at the at the kind of centrality of these problems in young people, in other words, are there particular symptoms that sit right at the heart of this network that may be influential in Maintaining and reinforcing this network.

So, for instance, we find that Feelings of nervousness and worry were particularly strongly connected to all of the other symptoms in in the network. What else can networks do? You can also use them to identify you know if you. If you do find particularly strong clusters in your data, you can use network analysis to identify okay. Well, what's bridging these clusters are there? Are there protect particular relationships that bridge the pairs that might give you some idea into the mechanisms that could potentially explain comorbidity? Network analysis doesn't have to just focus on symptoms. You could also build in risk factors, so this is another study we were looking. We had access to a gain some community data from this was from the North West of England about four household survey of about four and a half thousand people that collected a lot of information about their wellbeing. But also they're kind of living environment, their neighbourhood things like. Neighbourhood cohesion. You know the the access to green space, all these neighbourhood factors, but also individual level factors that could potentially influence wellbeing. So things like what's their health status, what is their employment model, status, relationship and basically. There had been some research out there that say that took a more reductionist approach to this and said. It's the neighbourhood factors and stuff, you know, access to green space, all of that there stuff – It's it's not really that important to to people's mental health and wellbeing, certainly not above and beyond people's individual circumstances. You know, really that what matters for wellbeing is are you physically healthy? Are you wealthy? Are you meaningful relationships? But what we tried to show is that you know it's it's actually far more complicated than this that the people's individual circumstances can kind of dictate their neighbourhood circumstances. If you're, if you're wealthy, you're more likely to live, maybe in areas with good housing conditions, good access to green space, those types of things. So basically, I'll not go through the paper in depth, but we basically mapped out all of the individual Connexions and both direct and indirect, between wellbeing and these different neighbourhood individual And individual risk factors. So those are just some examples of how network analysis can

be used to answer interesting questions. And I thought it’s important not to present this as okay. This is the way everybody should be doing research from now on. This is revolutionary. I think what you know with these types of things, you always have to present a kind of balanced perspective. And so the network approach kind of Appeared in some of the top psychiatric journals about 10-15 years ago, gained incredibly Incredible popularity. Hundreds of articles kind of started springing up out of nowhere But there’s also been controversy and criticism, so particularly from the The high top group, who I mentioned earlier. Starting in 2017, they started. There was basically a series of of articles published in the journal, which was formally called the Journal of Abnormal Psychology that recently changed their name and basically a back and forth between the two research groups where the high top people are saying, you know, criticising the network approach network, the network grid, particularly the bars from grip defending their position and this has been going back and forth for a couple of years now, the articles are quite civil. And the the Twitter spats are a lot less civil. They they’ve gotten some, they’ve gotten into some quite heated debates that I’ve not weighed in on other stuff. My popcorn and watched, but what are some of the criticisms levied at the? That’s the the network approach. One is is kind of. Methodological in nature that to these to these networks, how replicable are they? You know, you can imagine that they’ll change quite dramatically depending on the nodes in the network. That that’s a fair point. Is that a point that’s exclusive to network analysis only? I don’t necessarily think so. Any study, you know, there’s always variables, additional variables you could control for. If you can measure it, or if you’re using ongoing. It’s not possible to measure everything in the world, I guess other. Criticisms around the issue of the the kind of the complexity you know, particularly the Robert Kruger, one of the the kind of the big high top figures that said well. Basically, you’re going into far too much depth here. How are we supposed to unpack every single connexion within a psychopathological network? There’s too much here to actually. And you know, it’s of limited utility. Again, I

don't necessarily think I I agree with that. Again, if we looking at Miguel's talk earlier thinking about how you know the utility of looking at these specific processes and what they could tell us about broader. Broader mental health conditions. I don't necessarily think you can. I don't think there is such a thing as getting too specific when it comes to mental health research. Other criticisms? And and this is maybe a little bit more valid, is that the network approach has promised a lot but not necessarily delivered as much as it has promised, so? A lot of the early kind of think pieces of said OK, we can map out all of these these networks. We can identify key nodes within within psychopathology if we identify them, target them for interventions, the kind of the whole House of Cards will collapse. People we can come up with these better interventions that are much more targeted. In theory. I think that's a good idea, but there's just not. The empirical evidence there yet that that that's effective, or that people of managed to take the kind of network concepts and translate them into more effective therapies. I'm probably the biggest criticism, which again I think is fair. Based on where we are currently is is over interpretation. That most of these networks are cross-sectional in nature. Certainly the ones I've just shown there a lot of the research I've done is cross-sectional data And we can't determine causality or even directionality between these different elements in the networks. We can only hypothesise about potential mechanisms and not actually test them And and maybe when we're writing our articles, we can we can get ahead of ourselves and overinterpret certain certain Connexions. I heard one researcher referred to Cross-sectional networks as kind of the Rorschach ink blot test of epidemiology, you know you can look at them and say ohh well maybe that's causing that. Maybe that you can come up with all of these things, but it doesn't necessarily prove them. So all of those valid. Followed criticisms, I think. But. I think a lot of those criticisms are relevant to a lot of mental health research. More broadly, they're not specific just to the network approach. I think. Whether you're doing networks or traditional kind of survey research, or across lag models, any regression based research psychologist, we're not very good at

distinguishing between or, at least in my field against psychologists to broad field. But. A lot of a lot of researchers aren't good at distinguishing between between individual effects and within person effects. On cross-sectional analysis are probably the ages and the networks that I'm talking about are probably some mix of both between individual effects and within individual effects. So what do I mean by within individual effects and between individual effects? Maybe everybody already knows, I don't know. Depending on the audience, people usually are aren't familiar with these types of terms. I certainly wasn't until a couple of years ago I read this paper by Ellen Hammacher again that along with the. Kendler Paper (Kendler et al., 2011), one of my favourite papers ever. I read it and thought ohh after reading it I thought ohh so I've basically been been doing research wrong for the last couple of years, or at least with a lot more error in it than I imagined but Hammacher really talks about really spells out clearly the difference between. Between Paris and the facts and individual. Or within personal effects and why we need to think about these things. So let me let me see. So what do I what do I mean by with between personal effects and within person effects? I think the easiest way is to look at this within example so. Say, for whatever reason, I have a particular hypothesis that I want to to test, and that hypothesis is that the faster you type, the more errors you're likely to make in whatever it is you're typing. I'm proposing A mechanism here essentially that you know by sat down in front of my keyboard. If I type at a leisurely pace. And you know, I'll be going slow, but I'll be producing kind of reliable text free of errors. But if I speed up more likely to make errors so. If I were to convert that into a hypothesis or a research question, I might say okay I think there's going to be a positive correlation between typing speed and the number of errors. Now I could test that using kind of observational methods. I could conduct a cross-sectional study, say, get a sample of people, give them all the same bit of text on a piece of paper, sit them in front of computers, typewriters, whatever. Have them take out that bit of text as quick as they can and I could correlate the results about how fast did each individual type versus

how many errors did they. Did they make? What could? What would I expect to find? In that instance. We the faster, the more hours. That's what you would expect. Yeah, to find if you did that cross-sectional design, you might actually see something like this that there's a negative correlation between typing speed and the number of errors, which suggests that the faster you're typing, the fewer errors that you would make. And that's because we're not accounting. For a very, very important between individual. Effect. And that is. People who are good at typing say you're a professional typist. You've done a a typing course or some sort of office admin course or something like. People who are very fast at typing are probably very good typists and very unlikely to make errors where something who's you know you get, you know your your grandmother or grandfather, who's never used a computer, they're probably gonna type very slowly and make lots of errors. So that's the cross-sectional kind of pattern we're seeing. But within each individual. If we were to look at each individual within each individual, everybody has their own average speed. So if I'm sitting here and I'm typing. At a leisurely pace, nobody's paying attention to me. I'll probably type pretty slow. But you know, I'll not be not be distracted. I'll not be put off. I'm not under pressure. I'm unlikely to make any errors, but if my boss walks by and stands behind me and get in there and look busy and start typing really fast, going to increase my average speed, chances are then I might incur more errors. So if we looked so probably this is what's happening, probably in reality. But if we're only looking at, kind of. Inter individual differences? If we only measure in a in a kind of inter individual way, this is the pattern of effect that we're actually going to get. But if we account for those interindividual differences, we might see a kind of positive association between typing speed and the number of errors which would support our hypothesis so. How do we go about measuring things in this way And and separating out those interindividual and intra individual ages. So if we go back to the kind of cross-sectional networks. What we've got here? Any of these ages, it's probably some combination of interindividual effects or intra individual effects. So your ability to interpret these

ages depends largely on whether what are you talking about. Are you talking about an inter individual or an intra individual relationship? And again, I think we know certainly from my line of work I have this natural propensity to sort of think on an intra individual level that these things are. Causing these symptoms are maybe causing each other within an individual, but the data that I've used for instance here and a lot of my work is it can't make that distinction. How do we make that distinction? And. The the answer really lies in in probably all of our pockets or in front of us on our desks. Modern technologies have made it possible to gather rich, intensive. Longitudinal data will then within individuals, so there's been a kind of in the last couple of years even I've seen this. Explosion. It interests in ecological momentary assessment designs or or the the experience sampling method. And so in the mental health research I'm familiar with, these types of studies look like this. Where you get a group of participants to complete, say self reported survey datas, but intensively maybe multiple times per day. Maybe they use an app to get a notification okay. How are you feeling? Happy. Sad. Lonely. Not lonely. Very short surveys, but repeated within days across multiple days over maybe week, couple of weeks or something like that. And what this does is it produces a multi level data structure where you've got the kind of base level of analysis which is individual. Responses to a particular assessment. Those are nested within days, and those days are then nested within within participants. And from this you can, um, there's lots of different analysis you can do. Maybe people have used this type of data before, but if we look at the network approach, if you start feeding this type of data into networks, you can get some really interesting Results so. Again, one of the most common. Our packages for doing something like this at the moment. When you conduct a multi network analysis on multi level data which you actually get returned is 3 different types of networks as opposed to the sort of one network in the cross-sectional data. So I'll just go through some of these networks again looking back at the typing example so the temporal network. And this is basically within individual, so it's it's intra individual variation. How does one variable or

one node adds time point N predicts a different node at time point n + 1. So basically at the next assessment wave. So if we think about something like our say we did this design rather than just a one off typing experiment we had people do multiple times over a couple of hours or days or something like that. Would we expect some of these number of spelling errors? Or how fast somebody is typing this assessment to protect their spelling errors. When I get them to do the same thing in three or four hours time, maybe, maybe, maybe not. But we also have the contemporaneous network and what this is is basically. How personal deviations from a specific persons mean? What's that person's mean on a particular construct over the entirety of the study at a particular time point of the average? What's their average then deviation from the mains? Across the study and do they correlate with one another? So in other words here, what this would basically basically tell you that at the. Individual level the intra individual level when people are typing faster they're making more errors and it also separates out then the between subjects variants. So that's inter individual variation. So this tells you on average how do the means. Of different subjects relate to one another, so again this is picking up the sort of people who are just generally good typists, probably make make few error fewer errors generally. So you can see where partitioning out all of these different different variants. This is maybe a clearer example from the same paper which I like a lot. I think it's really good at. Highlighting the difference between a contemporaneous network and a temporal network. So say we're measuring people's energy levels and. Whether or not they're currently exercising, let's say we have a simple binary variable. Are you exercising right now? Then ask people to rate their energy levels on a 10 point scale. The contemporaneous effect when somebody, if I'm exercising right now, I'm on the treadmill. I've just started exercising. Say something. Ask me. How are you feeling? How energetic are you? Know you probably you're probably pumped at the start of your work out your getting into it. You're energetic. But then if we see how your. Energy levels are later in the day, or say at the end of the workout or after the workout. How are you

likely to feel after you’ve done your exercise? You’ve probably your bit worn out. You’ve expanded all that energy, and now you’re feeling more tired. So kind of exercise at a previous time point will negatively predict your energy levels out of subsequent time point. But if you’re having them predict each other at the same time point, there’s probably a positive correlation there. So in rambling about the stuff too long and probably nearly out of time, I’ll give an example of. Hope someone are some analysis we’ve done using this. This kind of approach. This is some work that’s in Prep that I haven’t had a chance to write up and finish this paper. So if anybody wants any PhD students want to do any writing and finish this paper for me that would that would be great. Not you, Caitlin, I’m having you doing too many papers already. And so this study, basically it was some data that was collected during the height of the COVID pandemic about 70 or 80 individuals they they reported on. They’re kind of affect levels during just a couple of times a day during the day for I think it was about two weeks. So they’re general. They’re feelings of kind of mood, you know, as your mood, your low mood, high high mood anxiety levels. You’re kind of anger, irritability levels, feelings of loneliness. And then we also have this interesting variable here, which I’ve labelled quite poorly. I’ve labelled as PC World one COVID worry. One. Really. What we’ve assessed there is we’ve asked people. Of quantified people’s exposure to COVID related information. Basically, have you been? Reading about covert online, watching the news about you, I mean, you all remember yourselves. That’s just it was for two years. Cover, cover, cover, everything was covered. And we wanted to see how that that exposure to that information fed into people’s kind of affect across across the day. So we we estimated our. Are longitudinal or multi level networks. If we look at the contemporaneous networks. We we nothing hugely interesting there basically at anyone assessment on average if you’re kind of Very recently been exposed to, to covet our or our news on in the background or something like that are you know, what’s your your anxiety levels like there there there or you’re kind of moods probably a bit lower, maybe a bit of irritability. Be. Stuff like that. But the

really interesting thing is if you look at the at the the temporal network. We found that the people who had. Experienced exposure to covert information at the previous assessment. This was positively associated with various kind of negative affects. So so anxiety, low mood at the next assessment, but crucially not the other way around. So this points. Doesn't and fair strict causality, but more so than a cross-sectional network, it suggests that. If you're exposed to call for information. Later on in the day or for further down the line in time you're you're more likely to maybe, maybe ruminate a bit about it. Maybe it's on your mind. Maybe your anxiety levels. Are aren't good. You're you're mood. Maybe is a little bit lower. But it's not just the case that while people who have a predisposition towards anxiety and depression are seeking out the COVID information, or it looks like there's that pathway doesn't seem to be represented in the data. So there you can see you can. It's just an example of how you can use this method to start the tease out more. Clear directional they have relationships between between protector. Variables so. Where does this go from here? That again, that story? I don't know if I'll ever be published. There's probably a million better examples of these temporal networks out there. I just wanted to show something that I had played around with. Where does this go in the future? Huge interest in my area of work in building the site, building capacity, expanding this type of analysis and approach. In different ways, bringing in, you know, passive data collection, let's let's see how these maybe surveys or or people's emotions. How do they relate to maybe physiological measures we can collect with all of our Fitbits and stuff like that. Can we look at contextual factors? You know our our phones are are collecting lots of data on on where we are, who we're with, who were interacting with how much time are we spending on on screen times. There's a lot of efforts being put into okay. How can we link all of this data up and take this intensive longitudinal data and see can we model these networks to see how these things are feeding into and reinforcing one another? And I think this is something that's going to. Become more and more widespread, more and more common. I was at a conference a couple of weeks

ago. Some colleagues of mine Who, who have worked with on on non network projects, non ESM projects. They both submitted fellowships. To to to lead their own research programmes. They were just independent of one another. They were both looking to do this type of stuff. You know, this kind of intensive longitudinal data. So lots of people seem to be increasingly interested in it. And I think, I guess what I want to end on is I think really there's we're only beginning to tap the potential for taking this This kind of network theory and approach, thinking about mental health as as complex systems. As the technology becomes more and more advanced as our ability to measure these things more effectively becomes more effective and nuanced. I think we can then start to. Really start to unpack. Ecologically valid mechanisms about how certain mental health problems may be emerge or are maintained. So those are all from me, thank you all very much for listening.Wwe've got the panel session later, so I ams happy to take any questions there.

1.3 Dr Belisle, “Relational Density Theory: Meaning and Essence”

hey, thank you so much for the invite, and thank you so much to everybody who is making the time and space either in person or virtually to listen to me talk about this relational density theory thing. The title of my presentation today carries 2 meanings. 0:1:3.510 –> 0:1:10.160

In one sense, I'm going to be explaining both the meaning of and the essence of relational density theory. 0:1:11.70 –> 0:1:23.400

It's a new concept in our field that we've been developing over the past three years. Since the first publication in 2020. Based on initial work on my dissertation that I was fortunate enough to have Doctor Barnes Holmes on my committee at that time. 0:1:24.560 –> 0:1:33.790

In another sense, the talk will also explore how the meaning

and essence contained in relational framing can influence mental health. 0:1:34.810 –> 0:1:38.950

And therefore how behaviour analysts might uniquely contribute. 0:1:39.960 –> 0:1:40.990

In this space. 0:1:42.550 –> 0:1:44.390

So I want to start by. 0:1:45.510 –> 0:1:57.170

With some acknowledgements, the 1st is. Although I'm presenting this work today, it's not only my work, it's the collective work of many people, including other scientists and practitioners who we work closely with. 0:1:57.850 –> 0:2:7.340

I want to especially acknowledge my research lab for their work. Current lab members are listed here and several other incoming lab members presented during the poster session today. 0:2:8.10 –> 0:2:32.360

2nd conflicts and funding sources, we work with a number of behavioural service providers in our university to generate funding opportunities for student researchers to support this work and have obtained seed grants from CBS. As far as book royalty royalties go, if anyone's looking to get paid significantly less per hour than they currently are, consider writing a book. And so those books are listed here as well. 0:2:36.780 –> 0:3:1.470

Today, we're going to talk about the concepts of meaning and the transcendental concepts of essence, then overview, relational density theory, and why it's needed. We'll apply the basic concepts to issues of mental health, then work through a group example together about midway, because 90 minutes is a long time, and then we'll conclude by talking about the role of culture on mental health challenges experienced in the United States and throughout the world. 0:3:3.40 –> 0:3:11.210

We make sense of our world through symbols and language in the field of semiotics. Semantics are the meaning that symbols carry. 0:3:12.520 –> 0:3:27.570

In the United States, this symbol means something like rock on derivative of devilish symbolism and rock'n'roll music. How-

ever, in some Mediterranean Latin countries this is used as a sign to tell someone that their spouse is cheating on them. 0:3:30.300 –> 0:3:40.30

If you were to walk into a Dutch supermarket, you might see this sign, which roughly translates to Mommy. I want this one, this one, this one. 0:3:41.560 –> 0:3:56.390

Of course, meaning can change overtime. For example, the happy poop emoji, which has an overwhelming number of appropriate uses today. Trust me, originally conveyed good luck in Japan, where emojis themselves originated. 0:3:58.500 –> 0:4:13.220

But some meanings never change. For example, Colgate Toothpaste Brand launched a frozen beef lasagna in the 1980s, and I don’t know about you all, but all I can imagine when I look at this picture is lasagna that tastes like toothpaste. 0:4:16.530 –> 0:4:16.890

She looked. 0:4:16.220 –> 0:4:23.0

The subfield of behaviour analysis, including contextual behavioural science, has always been a science of meaning. 0:4:23.710 –> 0:4:51.780

The idea of social validity ask the question is behaviour change meaningful? Can we become a science that helps others to find greater meaning and purpose in their lives? However, that shows up to find meaning and joy to find meaning and suffering. The purpose of behaviour analysis is not in anyway to a skew our humanity, but to discover it more fully and more completely. To experience it transcendentally and to evolve it in meaningful ways. 0:4:52.880 –> 0:5:17.940

And in behaviour analysis, there has been a huge emphasis on exploring human language in intervention for autistic and other neurodivergent learners, building language through verbal operant and relational training in behaviour, therapies like acceptance and commitment therapy, changing the way a person interacts with their world through language, often through some combination of conversation, experiential learning, guided by

analogy and metaphor. 0:5:18.760 –> 0:5:25.450

Operating under the assumption that experience can somehow be guided by the meaning that language itself carries. 0:5:27.320 –> 0:5:39.560

Behaviour analysis can be considered a pragmatic science for pragmatic philosophers like William James, John Dewey, Jane Adams meaning is contrived to solve problems. 0:5:40.200 –> 0:5:51.580

For example, this is a car. It's one example of a near infinite selection of cars. But exactly what makes it a car? Is it the colour red? Is it the windshield? 0:5:52.780 –> 0:6:8.90

Well, this is also a car. It's a 1921 lay at Helica or a propeller car. Not the greatest invention. The propeller on the front made it really difficult to see which was a disaster for pedestrians. And even worse, disaster if you're a pigeon. 0:6:9.40 –> 0:6:17.270

But the common structural element is that these two things both contain 4 tyres, so perhaps it's 4 tyres that make it a car. 0:6:18.350 –> 0:6:27.520

But wait, this is also a car, or at least a concept of a car by Volkswagen called a hover car designed with electromagnetic highways in mine. 0:6:28.490 –> 0:6:47.300

The point is, a car is not defined by its features, rather, by what it does, it's meaning it's rooted explicitly in its utility. What it refers to evolves as the object itself evolves as the context around it changes. Essentially meaning exists to solve new problems and new challenges. 0:6:48.340 –> 0:7:3.20

This assumption was inherent in Skinner's verbal behaviour theory that assumes meaning was established when the behaviour of the speaker was reinforced by the actions of a listener who had been trained at one point in time to differentially reinforce this behaviour in some specific way. 0:7:4.820 –> 0:7:19.490

Described as Skinner dead and still assumed within modern accounts of relational frame theory, meaning is culturally inherited, it is a system through which language is propagated

over time, meaning is stored generationally, for better or worse. 0:7:20.150 –> 0:7:28.810

The listener, for example, might be a parent who reinforces and shapes the verbal repertoire or meaning and understanding of the speaker, their child. 0:7:29.720 –> 0:7:35.910

Who in their time grows up to become the listener, who reinforces and shapes the repertoire of the speaker. 0:7:37.80 –> 0:7:42.330

Who in their time becomes the listener to shape the repertoire of the next generation? 0:7:43.410 –> 0:7:49.940

Through this process, simple and complex, even existential meaning is passed along and contained within culture. 0:7:50.620 –> 0:8:3.400

The same experiences by two people, let alone two people from vastly different cultures, will be understood fundamentally differently based on this cultural selection mechanism, symbolic selection or symbol type. 0:8:4.190 –> 0:8:9.110

And meaning can even change or transform overtime, even in a relatively short time. 0:8:10.370 –> 0:8:20.530

For example, in a majority Western westernised culture of the past to aspire to slay in, this presentation would pronounce a desire to harm the audience in some way. 0:8:21.810 –> 0:8:32.460

However, due to intersectional spread primarily through Black, Latin and gay cultures, and specifically within drag scenes, Slay portrays a very different meaning today. 0:8:37.330 –> 0:8:37.630 Amanda Gilmore You have. 0:8:33.160 –> 0:8:53.510

Metaphorically, that one is flawlessly killing it and expression of meaning culturally propagated in part by Beyoncé in 2016 and the popular song formation more than just slang, culture and diversity give even greater richness and meaning to relatively common expressions and experiences. 0:8:55.350 –> 0:8:59.320

Relational frame theory extends this account considerably. 0:9:0.370 –> 0:9:19.90

This image and taxonomy represents a common approach to RFT that is summarised in a book. We are in the editing phases of attempting to provide a more complete and updated account of RFT that incorporates contemporary models and findings, including doctor Burns, Holmes's hyper dimensional and multi level model, as well as relational density theory. 0:9:19.830 –> 0:9:50.500

In its most basic form, relational frame theory assumes that meaning is not always directly reinforced by a listener. Sometimes it is. Other times the listener themselves as abstracting meaning as an observer, oftentimes meaning is derived. For example, given knowledge that Jessica is older than Bob and younger than Tom, we might derive that Bob is younger than Tom and Tom is older than Bob. This can be expressed in technical and rotation as in the context of age. We know the relationship between Jessica and Bob, and Jessica and Tom. 0:9:50.640 –> 0:9:55.30

And therefore can derive the relationship between Bob and Tom. 0:9:58.360 –> 0:10:27.810

However, age is not likely the only way that these three people can be related. Perhaps in the context of speed, Jessica is faster than Bob, and Bob is faster than Tom. If so, then we might arrive that Jessica is also faster than Tom and Tom is slower than Jessica. These are just two examples of a myriad of ways that these three people or stimulus events can be responded to relationally, and the type of relation that has the most utility. 0:10:27.870 –> 0:10:31.980

Or meaning also varies moment to moment in context. 0:10:34.880 –> 0:10:44.980

So we can enter this into a three or four term contingency that behaviour analysts already operate and was first conceptualised by Skinner and expanded considerably since. 0:10:45.660 –> 0:10:51.10

In this case, the relational frames are contained as part of a relational learning history. 0:10:51.710 –> 0:10:57.20

Information that has been contacted in the past and can be recombined and near infinite ways. 0:10:57.670 –> 0:11:29.300

This learning history influences the control of discriminative stimuli, motivating operations, reinforcers and punishers on the behavioural response that may be of interest. In our case, mental health. For example, if Jessica is the fastest and Tom is the oldest, then in the context of competing in the track and field race might occasion selecting Jessica to perform the task. Winning the race becomes part of the relational learning history. By strengthening this relationship and increasing the probability of choosing. 0:11:29.370 –> 0:11:30.400

That’s the cut in the future. 0:11:31.90 –> 0:11:44.260

On the other hand, if two parents are going on a date for the evening, an emo that increases the reinforcing value of finding a babysitter that evening, then selecting Tom might be the logical choice since he is the oldest. 0:11:44.900 –> 0:12:6.810

The functional context in this case selects for the most logical relational dimension in the moment. Relational learning is not an all or nothing phenomena, it’s a generalised operant that grows in complexity along with experience moving from relatively simple forms of relational responding in childhood to vastly complex and interdependent relational repertoire. 0:12:7.800 –> 0:12:22.640

Thus meaning itself is a transformational process as language emerges, so too does meaning from the relatively simple meaning of our childhood to the complex meaning of us here together in our world today. 0:12:29.960 –> 0:12:30.290 Amanda Gilmore Feel. 0:12:23.670 –> 0:12:52.340

We conducted a study just this year that has the potential to model this emergence by doing a cross-sectional analysis of the peak comprehensive assessment or the PCA. We conducted the assessment with just over 100 autistic learners. There are 344 items in the assessment, so we analysed over 34,400 pieces of data using something called a principal component analysis, also called a PCA. So we did a PCA of the PCA. 0:12:52.980 –>

0:13:0.310

By doing so, we can see how each of the different ways that we use language emerge relative to one another over time. 0:13:1.100 –> 0:13:7.670

That is, we can see the interdependency of the various elements that comprise human language and cognition. 0:13:9.500 –> 0:13:10.310

For those. 0:13:15.240 –> 0:13:15.840

How far away? 0:13:7.850 –> 0:13:16.610 Amanda Gilmore Frequent pigs, pigs and I want I have stage takes. Wait, what you doing with? It's not that far away, I thought. 0:13:16.460 –> 0:13:38.960

For those less familiar with Pete, I made a table to help visualise the types of programmes we see in the curriculum. Green items are directly trained items, red items are generalisation of the direct training content. Both of these two things are based on a skinnerian verbal operant theory that relies heavily on directory enforcement learning and formal similarity between stimulus events. 0:13:39.690 –> 0:13:50.310

Blue refers to stimulus equivalence items or early frames of coordination, and yellow are relational framing items across multiple frame families. 0:13:51.180 –> 0:14:4.930

Level 1 items are simpler. Versions of these operates denoted by a circle. Squares are a bit more complex, diamonds even more complex, and then triangles are the most complex items found in that domain. 0:14:5.880 –> 0:14:7.450

So how do these all go together? 0:14:9.410 –> 0:14:17.440

Well, first we have to get some arbitrary stats out of the way. This is called a screen plot. It basically says how many factors are clusters are in our model. 0:14:18.250 –> 0:14:33.90

It appears to be a three factor model, but kind of it's highly interdependent. The Egan values don't approach or go below that one value, so it's not as if we have three independent clusters of this languaging event. It's highly interdependent. 0:14:33.930

–> 0:14:48.100

Well, we know that three could give us a provisionally workable model because of where the elbow starts to form in the plot. Now this is not inherently interesting, but what it does mean is that we can graph the emergence of complex language in three dimensions. 0:14:49.350 –> 0:15:0.400

And here is what we get. The axes are arbitrary and it’s the relative distribution of each element within the space relative to each other element that matters. 0:15:1.270 –> 0:15:14.680

To help visualise, imagine a learner just beginning to explore their language development. They would start here with elementary verbal operands, built primarily through directory enforcement. 0:15:16.810 –> 0:15:27.380

Early in this development, they would start to show simple forms of generalisation, and then you would start to see elements of reflexivity and symmetry showing up in the repertoire. 0:15:28.170 –> 0:15:38.960

All of these interdependent and interconnecting the formation of reflexivity and symmetry, making it more likely that they’re going to learn through directory enforcement learning as well as generalise that learning. 0:15:39.780 –> 0:15:55.440

And then we start to see transitivity and equivalent show up in the space along with those other relational frame families from relatively simple to incredibly complex forms of relational framing, ultimately transforming the function of their world and all that it entails. 0:15:56.270 –> 0:16:11.960

To me the graph looks kind of like a dragon, which is pretty cool. To my knowledge, this is the first glimpse of into the emergence of relational behaviour. Viewed through this lens and so you guys are some of the first people in the world to see these data. 0:16:13.340 –> 0:16:26.510

So what are we doing when we start to integrate verbal behaviour and relational training into something like AB programming? We’re introducing new ways to view and perceive the world with greater meaning and deeper understanding. 0:16:27.390

–> 0:16:36.760

What is most critical for us today is the interdependency of verbal relational behaviour with other forms of verbal relational behaviour. 0:16:38.110 –> 0:17:8.180

Now, this idea that the elements that comprise language and cognition may be highly interconnected and operate in non linear ways is not necessarily new or novel. It's been in the air for a very long time. Cantor extended on the field theories of Albert Einstein and also the pragmatic theories of John Dewey to account for psychological interview behaviour. That is, the psychological behaviour is so complex that it cannot be easily reduced to its elemental. 0:17:8.260 –> 0:17:8.700

Parts. 0:17:9.620 –> 0:17:40.40

Doctor Barnes, Holmes and colleagues proposed that RFT may be more of a relational field than separate relational frames. That is, there is no singular relation or set of relations that constitute A relational response. It is the sum of the various interacting elements that comprise complex framing systems that vary across dimensions and levels, producing equally interdependent units of analysis that includes acts of relating, orienting, and evoking in a context. 0:17:40.920 –> 0:18:2.700

Results reported in the Iraq and the taxonomy described in the HTML were hugely inspirational in the development of relational density theory that attempts to evaluate the interdependent interaction of relational framing events quantitatively describing higher order relational properties such as relational volume density and mass. 0:18:5.700 –> 0:18:16.890

When we start to talk about something like a relational field, we necessarily stumble into areas of discourse that have been operating for decades in philosophy and science. 0:18:17.550 –> 0:18:24.400

Which are themselves sophisticated language systems from which to extract meaning and to achieve understanding. 0:18:25.480 –> 0:18:35.550

Const critique of Pure Reason challenged Decartes idealism,

positing that knowledge is gained from the outside in much like Skinner’s account and relational frame theory. 0:18:36.870 –> 0:18:51.620

Philosophers extending from Conte, delineated between deductive logic that very much resembles RFT models like I just described, and transcendental logic that moves beyond meaning to discussions of essence. 0:18:53.220 –> 0:19:7.320

Which essentially proposes that no singular element of a thing X is necessary for X to be true, because X is an aggregate of the various elements that X entails. 0:19:9.380 –> 0:19:13.670

For Santayana, the essence of a thing is simply everything about it. 0:19:14.670 –> 0:19:16.410

Independent of its existence. 0:19:17.230 –> 0:19:20.770

Essence is wetness as distinct from that Ness. 0:19:22.160 –> 0:19:29.910

Essence is the meaning that persists even when the specific elements erode or decay. 0:19:33.260 –> 0:19:42.680

Skinner alluded to the essence of learning in his quote. Education is what survives when what has been learned has been forgotten. 0:19:43.890 –> 0:19:45.940

It is the essence of the thing that remains. 0:19:47.50 –> 0:19:49.40

Or from an RFT perspective. 0:19:49.960 –> 0:19:53.470

It’s the space that exists between. 0:19:54.220 –> 0:19:55.180

The relations. 0:19:56.230 –> 0:20:14.290

And this idea of essence has remained a fixture in contemporary philosophy, perhaps most notably as expressed by the great philosopher, scientist Joey and Chandler from friends, who said that the cushion is in fact the essence of the chair. If anybody’s seen that episode. 0:20:15.960 –> 0:20:30.340

The broader point is that moving from the simple straight forward meaning of things to the broad essential meaning of things requires updating and refining our current relational frame theories, and I’ll show you why. 0:20:33.490 –> 0:20:45.680

Be RT that I just described is relatively simple and relatively straight forward. There's a lot of new terms to impact that can be intimidating for people, but but broadly it boils down to something like this. 0:20:46.780 –> 0:21:2.330

The problem is that the relational repertoire becomes more and more established. The possible ways that one's relational history can influence their behavioural and mental health becomes increasingly more vast and more complex. The challenge is that everything. 0:21:3.170 –> 0:21:8.620

The challenge, sorry, the challenge that relational density theory is meant to solve is one of complexity. 0:21:9.370 –> 0:21:31.300

As long as things are simple and everything is the same as every other thing, and a network relational frames are relatively easy to work with and traditional models hold, this has been the basis of things like matrix training or equivalence based instruction. In these simple networks, we can easily determine relations that were established through directory enforcement or instruction, and those that were derived. 0:21:33.870 –> 0:21:50.190

Complexity arrives initially by the introduction of New C, Rails, or contextual cues. For example, a might be different from B, might be different from C&C, might be different from a. That is, these three stimulus events are related in terms of distinction. 0:21:51.0 –> 0:22:7.270

Approaching the various relational frame families in this way is the basis of RFT and informs training programmes like the peak relational training curriculum or the SMART programme that has since generated a lot of evidence supporting their utility in promoting things like intelligent behaviour. 0:22:8.490 –> 0:22:19.480

We can get more complex still when multiple frames interact. For example, what happens when a is similar to B&C but not perfectly the same, nor entirely different. 0:22:20.220 –> 0:22:40.550

That is, parts of this small network are same parts of this

small network are different. We have opposing forces pulling on the network, creating differential relatedness viewed as a dichotomy, there are both same and different relations occurring at the same time, but the question is how similar to one another. Are these stimulus events? 0:22:42.580 –> 0:22:48.690

We can model this interaction geometrically by showing the space that exists between the relations. 0:22:49.380 –> 0:23:2.710

The further 2 stimulus events are from one another, the more distinct or dissimilar their relationship. We see this with B in relation to both A and C where difference is much stronger than sadness. 0:23:3.490 –> 0:23:16.980

A and C are much more closely related, pulled by a learning history, establishing greater coordination. For example, a might be a dog Inc as a cat, while B is something random like a Ferris wheel. 0:23:19.50 –> 0:23:40.960

We can clean up our visual display by simply measuring the degree of relatedness of the three elements. That includes the multiple ways in which these things can be related. We assume that everything is related to everything else in some way and the distance in this representation shows the degree of relatedness or relational density. 0:23:41.640 –> 0:23:45.550

So we can remove the words as well to make it even cleaner. 0:23:47.510 –> 0:23:53.720

We can clean this up by simply measuring the degree of relatedness of the three elements. That includes the multiple ways that they’re related. 0:23:55.260 –> 0:23:55.800

But wait. 0:23:56.600 –> 0:24:7.170

Think of anything in your life that operates as a three member network. It’s not there, it doesn’t exist, so we can simulate it in the lab. But how much is this representing reality? 0:24:7.960 –> 0:24:20.50

And although researchers or sorry, although research was small, networks can give us information to start to conceptualise. The whole really networks made more closely resemble

something like this. 0:24:21.0 –> 0:24:28.110

When we add additional relations, we too quickly arrive at what Jack Maher referred to as a mingled yarn. 0:24:28.950 –> 0:24:47.340

While we know that everything in this space is related to everything else in this space, in some sort of way, some elements are the same. Some elements are different. So let's go ahead and clean this up a little bit more by eliminating the lines, because we don't need both space and lines to illustrate degree of relatedness. 0:24:48.120 –> 0:24:48.870

One will do. 0:24:49.780 –> 0:24:59.180

And what we're doing as we're kind of working through this is we're subtracting information. This information might be true at a more molecular level of analysis. 0:24:59.800 –> 0:25:8.190

So that we can view relational behaviour at a more molar level of analysis. That's not to say that those lower level interactions do not matter, they do. 0:25:9.160 –> 0:25:15.290

And I addressed this in a paper on model dependent realism and level scaling of relational models. 0:25:16.130 –> 0:25:23.180

Lower level events are assumed within the analysis of higher level events they're occurring. We're just not paying attention to them in this analysis. 0:25:24.170 –> 0:25:39.920

Just like how something like verbal mediation might may or may not support the development of entailed relations, this could provide important information. For example, when teaching early instances of deriving, but this information becomes less and less relevant as you move into complex networks. 0:25:40.720 –> 0:26:2.250

In the same way, which elements of the network were derived or directly taught, or the contextual cues that situate each element in the geometric space as relative to other elements becomes less and less relevant the higher you go in your analysis, and this is especially important when dealing with real world relations where we might not know the learning history that pro-

duced it. 0:26:3.190 –> 0:26:4.320

Rarely will we ever. 0:26:5.510 –> 0:26:21.80

Instead, we can start to talk in more abstract, higher order properties. For example, it appears we have two networks here defined in terms that in terms of the space between the relations, the volume of network one. 0:26:21.920 –> 0:26:27.50

Um is 4 and the volume of network two is 12. 0:26:27.680 –> 0:26:36.510

Therefore, we can say that network two is 3 times the volume of network, one volume is the number of stimulus of NTS contained in the network. 0:26:38.980 –> 0:27:6.270

And if we’re measuring in something like dimensional units, using a geometric space or geospace like in some of the posters you just saw along 2 abstracted dimensions, then we can start to talk about the relative distance between any elements within a complex network. Or we can obtain a measure of relational density, or the proximity of each element within the network to each other element. 0:27:7.500 –> 0:27:35.730

Not only that, but if we abstract this as two networks, we can measure the space between the centre of both networks, giving an an estimate of one way in which networks might cohere or not cohere. In this case, a coherence estimate of approximately 5 units separates these two networks and might give us some information about something like how likely are these two networks to merge together when contingencies shift? 0:27:37.920 –> 0:27:56.610

So again, let’s remove the scale for now to clean up our visual with these concepts of density and volume, we can start to do some really cool things. For example, in behaviour momentum theory, Nevin and colleagues describe behaviour properties like mass or resistance to change using Newton’s models metaphorically. 0:27:57.280 –> 0:28:10.290

In the equation, a change in behaviour, in this case relational behaviour or a delta R is equal to negative X or a force applied against the network, like competing information or a shift in the

external contingencies. 0:28:11.210 –> 0:28:11.940

A disruptor. 0:28:12.690 –> 0:28:17.90

Over N or the resistance of the behaviour to change. 0:28:18.10 –> 0:28:20.730

The question, of course, is what produces M. 0:28:22.430 –> 0:28:42.200

In 2020, we expanded this account and suggested that mass might be a derivative of volume and density, and this is consistent with Newton's basic framework. The greater the number of relations within a network and the stronger those relations are, the more resistant the relational network will be to change. 0:28:43.970 –> 0:28:44.640

For example. 0:28:45.440 –> 0:28:57.440

Under the same contextual pressure designed to pull the stimuli B&P from their respective networks, we might see B move a lot while P only moves a little bit. 0:28:58.230 –> 0:29:2.450

Let's say you were told that P is different from L in our network. 0:29:3.200 –> 0:29:27.390

Okay, but we still have a learning history relating P to all of the other elements in the space that are essentially holding P in place. It cannot move that much because all of those other relations still remain. Because of this, we might say that P is resistant to the C rel of difference as it relates to other stimuli in the network. Essentially it's held in space. 0:29:28.250 –> 0:29:34.660

The stimulus B, on the other hand, can move more freely because it has fewer Connexions holding it. 0:29:37.540 –> 0:29:45.190

Let's go even more molar here. We have two relational networks A and B of differing volume and density. 0:29:45.910 –> 0:29:54.570

B is higher mass than a. It has more class members and the average space between stimuli and the network is 6 times less. 0:29:57.40 –> 0:30:7.130

Not six, but it’s less. Now let’s add a third network X that could be ambiguously related to either network. It could go to a, it could go to B. 0:30:7.920 –> 0:30:20.90

And we might arrange an external VR contingency where reinforcement is equally available for responding to X in terms of either A or B. So how do we respond to X? 0:30:20.770 –> 0:30:26.840

Well, if we use something like gravity as a metaphor, it’s more likely that X merges with which one. 0:30:29.190 –> 0:30:29.800

B. 0:30:30.560 –> 0:30:30.980

Right. 0:30:31.770 –> 0:30:51.370

Acts may be more likely to merge with B if force or pull is exerted by the greater mass network A in real world terms, what is occurring is that we are perceiving ambiguous events in our world that could be interpreted in multiple ways in terms of information that we already know or biases that we already hold. 0:30:52.60 –> 0:30:54.730

In cognitive psychology, this is called a schema. 0:30:55.650 –> 0:31:5.220

In our metaphor, it is as if the high mass elements of a relational learning history are exerting gravity on relational responding that operates in the present. 0:31:6.300 –> 0:31:21.240

This is exactly the outcome that was achieved initially in the study that I conducted with Mark Dixon in 2020 as part of my dissertation and again in the study conducted by myself and Doctor Michael Clayton that proposed this as one way to approach coherence. 0:31:22.820 –> 0:31:39.240

A question, of course, is why does this happen, right? We’re talking about the aetiology of mental health. So we have to deal with those kinds of questions. Well, these kind of ideas are descriptive, not ontological. Ultimately, it is probably all coming back to reinforcement. 0:31:40.80 –> 0:32:10.450

I imagine that we all have a denser learning history of re-

sponding to events in terms of other events that were deeply familiar with or that are already meaningful in some way. When we try to interpret novelty through the lens of already established high mass networks were more successful than when we do otherwise. Thus relational density theory is best described as an extension of RFT, which can be described itself as an extension of Skinner's operant theory applied. 0:32:10.790 –> 0:32:12.200

To relational framing. 0:32:15.80 –> 0:32:24.810

We've been busy in the lab um trying to vet the various elements of this model and trying to search for anomalies that can expand the account. 0:32:25.590 –> 0:32:53.220

At first, this work was largely conceptual and basic, where we've seen research evolve and largely driven by the interests of students on this project is towards translational analysis that are necessary to build technologies that can be used on the ground by practitioners. We're trying to proceed cautiously and empirically, and if we're correct, then this work offers a view into the future of what technologies like act might do to support things like mental health. 0:32:53.920 –> 0:33:0.710

I want to walk through a series of two basic studies that I think are highly relevant before getting into applications here. 0:33:2.550 –> 0:33:10.180

The first is a study that we conducted on affective or emotional transfer of function as it occurs within these complex networks. 0:33:15.80 –> 0:33:26.220

Emotions, the way that we feel are at the heart of our experience as verbal humans, and much of the work in research and mental health is meant specifically to tackle challenges and struggles of human emotions. 0:33:26.830 –> 0:33:52.20

So myself, Doctor Cutrone and doctoral students at the Chicago School of Professional Psychology have been attempting to understand these emotional experiences through a contextual lens and in terms of relational density in the affect of psychological literature in repeatedly in earlier translational density research,

clustering of emotional experiences appears to show up along these common dimensions and are occurring consistently. 0:33:52.890 –> 0:33:59.950

Arousal functions, or those that excite or inhibit action, high arousal do more low arousal do less. 0:34:0.670 –> 0:34:14.20

Aversive functions make us avoid or escape situations. Appetitive functions make us approach situations. For example, fear is a high arousal negative emotional experience, whereas call might be a low arousal positive experience. 0:34:14.740 –> 0:34:20.100

This account is deeply compatible with Skinner’s account of positive and negative reinforcement and punishment. 0:34:21.10 –> 0:34:37.350

We act in ways to contact stimulation that is positively valence into avoid stimulation that is negatively valenced, which is why the ongoing act of feeling itself is so important, whether positively or negatively, valenced feeling is what matters. 0:34:38.590 –> 0:34:58.800

And all of this occurs in a context. Language mirrors emotions, like in black ledges, reinterpretation of Lang’s fear network where we see that in the context of taking an examination or a test, all of this language can show up in evoke avoidance of the exam in the form of procrastinating, perhaps even cheating on the exam, and so on. 0:34:59.510 –> 0:35:7.130

On the other hand, language can also establish A petite or positive excited emotions around the act of exam taking. 0:35:7.800 –> 0:35:24.710

The point is, either way it’s rooted in language around exam taking from an RDT perspective, the question we might ask is which of these networks is the higher mass network operating in this context? From it, we might produce the behaviour as it relates. 0:35:25.520 –> 0:35:26.590

To exam taking. 0:35:27.950 –> 0:35:49.400

So for the study, we recruited 24 college student participants

for the initial study and we have another 82 participants in the sample to analyse. So these data that I'm going to show you here are based on this original sample in phases one and two, we establish 63 member classes to develop a complex 18 member network. 0:35:50.40 –> 0:35:57.820

The stimuli included faces depicting either happy or angry emotions and arbitrary symbol, and an arbitrary word. 0:35:58.580 –> 0:36:2.10

In phase three, we attempted to merge some of the classes. 0:36:2.640 –> 0:36:9.130

In the coherence group, the merger was coherent, meaning the emotional valence of the merged stimuli were similar. 0:36:9.950 –> 0:36:17.40

In the incoherent group, the merger was not coherent, meaning the emotional valence of the merged stimuli were dissimilar. 0:36:17.800 –> 0:36:34.860

Then we developed an analysis of relational density to show the relational network in a geometric space using the multiple using the multidimensional scaling procedure. And then we tested the emotional balance of each stimuli using the semantic differential scale. 0:36:36.280 –> 0:36:37.650

So I'll show you what that looks like. 0:36:40.820 –> 0:36:48.550

The multidimensional scaling procedure was originally used to analyse relational patterns by Clayton and Linda Hayes in 2004. 0:36:49.350 –> 0:37:5.610

We use the arrangement from my study with Clayton in 2020, where participants were presented with pair-wise images and asked to rate the relatedness of the images to one another on a 10 point scale where ten was most related and one was least related. 0:37:6.240 –> 0:37:29.480

By knowing the relationship of each stimulus to each other stimulus, A geospatial representation of the network can be achieved. The statistics borrow from Euclidean geometric logic that is way over my head. In my world, it's hit the right buttons in the

statistics programme. Some magic happens more or less and you have depiction of the relational networks. 0:37:32.440 –> 0:37:58.870

And we utilise the semantic differential scale. That’s several Brazilian researchers, including in the study by Bartolucci and Derose have been using in their research on meaningfulness and emotional stimuli. In this scale, you’re presented with a stimulus and asked to compare between emotional adjectives. For example, is the word SEC more angry or more happy, more tense, or more relaxed? 0:37:59.590 –> 0:38:11.280

The negative selections are assigned to corresponding value negative value, for example -, 2 and positive selections are assigned to corresponding positive value like positive 3. 0:38:11.980 –> 0:38:23.840

Now in this study, the actual values and their negative and positive integers were not shown to the participants because these symbols themselves may already carry approach and avoidance functions. 0:38:25.830 –> 0:38:37.790

The stimulus pairing procedure that we use to establish the network looks something like this. We showed a first image, followed closely in time by a second image, followed by a blank screen. 0:38:39.460 –> 0:38:47.590

Then a next image was presented, followed closely in time with its coordinated image, followed by a blank screen. 0:38:49.290 –> 0:38:59.490

Altogether, we had six phases, all female presenting to avoid gender as a confound given our previous research showing relational differences along a gender binary. 0:39:0.330 –> 0:39:13.980

Faces were obtained from the facial emotion recognition 2013 data set, constructed with thousands of responses and augmented by AI technology. So we know from broad sample that these are perceived to be either happy or angry. 0:39:15.500 –> 0:39:18.710

These specific faces represent happy. 0:39:20.810 –> 0:39:21.600

An angry. 0:39:22.530 –> 0:39:31.280

So classes one to three were positively balanced, whereas classes 4 through six were negatively valenced. 0:39:33.620 –> 0:39:40.770

The phases were paired with the following unfamiliar beast stimuli that included wing Dings that we've used in other studies. 0:39:42.400 –> 0:39:56.470

Um, after each stimulus pairing phase, we tested correct responding in a match to sample task, including A to B to CA, to CC to B as well as the merged relations, which we'll get to in a second. 0:39:57.730 –> 0:40:9.200

Participants showed mastery of the trained A to B relations, but not the derived transitive or equivalence relations, which makes sense given we have not yet introduced any of the C stimuli. 0:40:13.60 –> 0:40:14.30

Not a problem. 0:40:14.790 –> 0:40:29.250

So then we train those relations in the testing phase, all of the relations popped, including the dry transitive and equivalence relations. To this point, the experiment, we know that we've established 63 member classes more, less. 0:40:30.510 –> 0:40:36.280

And therefore we might assume the transfer of emotional functions through the network. 0:40:38.960 –> 0:40:55.210

So after we have A to B&B to C, the next phase was the coherence and incoherence merger, just like in the study that Clayton I conducted for the coherence group, B1 and B2 were paired. Both were positively balanced in our arrangement. 0:40:55.940 –> 0:41:7.910

And be three and four were paired both negatively valenced for the incoherence group B1 and B3 were paired that differed in their valence functions, and B2 and B4 were paired that also differed. 0:41:8.800 –> 0:41:16.680

The difference between the two groups, therefore, is that the merger was either centred around pre-existing valence emotions or relational coherence. 0:41:17.700 –> 0:41:31.390

Whereas the other group was not. It’s also important that our merger took place with the bee stimuli that we’re only coherent or noncoherent based on their shared relationship with the A stimuli that carried the relational learning history. 0:41:32.310 –> 0:41:37.630

Therefore, showing a potential gravitational influence of this history on learning the relations. 0:41:38.380 –> 0:41:57.930

In the post test, it should come as no surprise that percent accuracy was lower for the incoherence group compared to the coherence group. But what does this look like in the geospace? So let’s start with the incoherence group. In this group, we loosely see the combination of two networks based on the valence functions and not the class merger. 0:41:59.100 –> 0:42:14.760

We see the classes one through 3 on the left and four through 6 on the right. Even the B stimuli that were merged remained distant from one another, showing resistance to change when that relation went against the previous relational learning history. 0:42:15.830 –> 0:42:35.200

We also included stimuli BX and BY that participated in our merger. These were paired with the remaining B3 and B6 stimuli respectively to balance our presentation and here we see generally that BX was more positive than Bo Y, but the space between them isn’t that great. 0:42:35.810 –> 0:43:5.440

But what is interesting about the data from this group is that we do not necessarily see that a one is closer to B1 or C1, which we’re directly paired. Then they are to other BNC stimuli. It’s as if the actual classes that we train did not necessarily hold, rather it was the essence of positive and negative valence of the stimuli that organised the relational field. The specifics were lost, but what remained were the emotional valence of the stimuli that seemed to sort the network. 0:43:6.300 –> 0:43:7.920

All right, let’s see the coherence group. 0:43:9.280 –> 0:43:16.630

Same general pattern or distribution, but significantly greater relational density and the same volume, therefore greater mass. 0:43:17.430 –> 0:43:34.460

The classes just collapse on themselves to create two clearly distinct networks. It's as if the great it is as if the greater within class coherence or pre experimental relatedness of the faces pulled in the other stimuli when the stimulus pairing was consistent with this history. 0:43:35.620 –> 0:44:5.830

Again, we introduced BX&Y and again BX was paired with B3 and BY with B6 for the coherence group. The stimuli emerged right in the centre of our two networks, so the influence of our external context in this case stimulus pairing was mediated by the relational mass of the class, as would be predicted by our coherence function, as if the network was exerting gravity on these on each of these arbitrary stimuli. 0:44:5.930 –> 0:44:6.130

Ohh. 0:44:9.160 –> 0:44:15.970

Here we have the semantic differential data between the two groups. So here's our transfer of emotional or affective function. 0:44:17.170 –> 0:44:26.800

1st we have the positively valenced, a class which where our faces the faces carried the valence. So this outcome should not be surprising. 0:44:27.980 –> 0:44:30.630

We have the opposite effect for negatively valenced phases. 0:44:31.750 –> 0:44:32.400

As well. 0:44:34.180 –> 0:45:4.200

Um, what's interesting about this is that for five of six faces, greater balance in either positive or negative direction was observed for the coherence class, and so the happy faces were perceived as more positive for the coherence class and the negative faces were perceived. Sorry the angry faces were perceived as more negative for the coherence class. So when we had relational coherence, the same faces were seen as a greater absolute value of emotional valence based on their relationships with arbitrary symbols and words. 0:45:6.700 –> 0:45:34.350

Um, we have the same general outcome for our bee stimuli and for our C stimuli. There was limited emotional transfer for the incoherence class. However, this transfer was retained for the coherence class, so in our coherence class we see the emotions

transferring from A to B&B to C but for our incoherence class we see some transfer from A to B and then a muted transfer as it relates to C. 0:45:35.910 –> 0:45:48.620

On the right we have the absolute balance value. So we converted each to a positive number for comparison. And what we see is that the absolute values are greater for a B&C stimuli in the coherence networks. 0:45:49.590 –> 0:46:4.0

We also see greater transfer of positive versus negative affect. Altogether this is consistent with the happiness superiority effect described by Bartolucci at all in similar research in appears to be a consistent finding across our studies. 0:46:4.680 –> 0:46:16.30

We also see a reduction in the absolute value for both groups. The further we get from the A stimulus consistent with research on nodal distance as well as the concept of relational volume. 0:46:16.750 –> 0:46:25.490

We also see that the difference between the coherence and incoherence group becomes greater the further we get from the A stimulus. 0:46:26.450 –> 0:46:35.0

And we lose that happiness superiority effect on C for the coherence group, which is also a potentially interesting outcome. 0:46:38.910 –> 0:46:39.280

I. 0:46:40.760 –> 0:46:51.200

I was blown away. You um. If so, if we’re being behaviour analysts or contextualist, relational framing is also influenced by external contingencies of reins. 0:46:52.420 –> 0:47:0.960

We risk being mentalistic if we say that relational behaviour causes over behaviours of interest or even our emotional experiences. 0:47:1.660 –> 0:47:9.110

The external context plays a central role in relational density theory and is expressed by axe and negative X in our models. 0:47:10.70 –> 0:47:24.730

This next study was designed with Doctor Allison Stapleton and two of my students and colleagues to evaluate the effect of

contingencies of reinforcement and punishment on rural government behaviour when rules were supported by low or high mass relational networks. 0:47:25.630 –> 0:47:36.640

So for this study, we recruited 24 college students. In phase one, they underwent relational training using a modified version of the stimulus pairing procedure that I showed you earlier. 0:47:37.780 –> 0:47:38.770

A Group One. 0:47:39.490 –> 0:47:45.310

Underwent coherent pairing and Group 2 underwent incoherent pairing. Here were the pairs. 0:47:45.970 –> 0:48:10.480

The coherent group was coherent because the 1st 2 letters in the network were the same letter in either upper or lower case form, presumably establish through a pre experimental learning history that is incredibly dense and shared by the culture, so we assume that the participants are showing up to the experiment relating capital R to lower case R and capital E to lower case E. 0:48:11.400 –> 0:48:14.240

The other stimuli in the network were unfamiliar symbols. 0:48:15.330 –> 0:48:30.380

In phase two, we gave participants a rule to follow that required responding consistently with the relational classes by selecting the stimulus arrangement that contained the most images that were like an image presented at the top of the screen. 0:48:31.550 –> 0:48:44.520

In phase three, the contingency shifted such that, following the rule no longer produced reinforcement and instead participants lost points and points were available for responding in the opposite way. 0:48:45.910 –> 0:48:54.130

We conducted MDS analysis on 4 occasions throughout the study to see how the relational field reacted to the contingencies of our programme. 0:48:54.840 –> 0:49:3.120

Immediately before relational training, immediately after relational training, before the contingency shift and after the contingency shift. 0:49:4.500 –> 0:49:6.900

So here’s what they saw during the rule task. 0:49:7.740 –> 0:49:16.150

They were presented with a symbol at the top of the screen, for example the letter east, and they were given the rule. Choose the stimulus that is the most related. 0:49:17.20 –> 0:49:32.50

So in this case, this response has three stimuli that are contained within the relational network that includes this ease stimulus. So the correct response required selecting the image that contained only class related stimuli. 0:49:33.880 –> 0:49:53.190

However, in the contingency shift, the exact same rule was presented in the exact same arrays were presented. It was unsignalled, so nothing in the environment would signal that the contingencies were changing. However, points were only awarded when they selected the lease related stimulus in the array. 0:49:55.260 –> 0:50:3.290

And so here are our results in terms of percent accuracy in the accurate rule phase, both groups responded approximately the same. 0:50:4.50 –> 0:50:13.440

We still need to look into response latencies, but for now this is what we have responding with slightly more accurate for the coherence group, but not statistically significant. 0:50:14.190 –> 0:50:25.490

We see the greatest difference after the contingency shifted, the coherence group was able to more quickly adjust their responding and build to almost 500:50:26.220 –> 0:50:37.530

So we need to do a deeper analysis of what were the types of errors, and we’re going to do that over the next few months before attempting to publish this work. So again, you guys are some of the first people to see these results. 0:50:39.730 –> 0:50:43.180

The under MDS results are really telling in this experiment. 0:50:43.880 –> 0:51:13.810

Here are the results of time one before relational training. These results make sense. We have two main clusters. We have

letters on the left. Unfamiliar stimuli on the right. The uppercase is close to the lower case, EE the uppercase R is close to the lower case R the letters are clustered more densely. Given a greater history. So this is the higher mass network and therefore we should expect that future framing patterns will organise around the letters rather than the letters. Organising around the symbols. 0:51:15.210 –> 0:51:17.600

That's what makes this either coherent or incoherent. 0:51:19.270 –> 0:51:34.360

And this is exactly the result that we get at time 2 conducted right after relational training and before they experience any contingencies at all in the coherence group. We see it collapses into two clear networks organised by letter type. 0:51:35.150 –> 0:51:55.760

In the incoherence group, there is no clear organisation. In fact, the same letters are still closer together even though they were trained as being part of opposite networks, suggesting that this previous history was too great in mass and was highly resistant to change. And so again, consistent with our resistance equation. 0:51:57.200 –> 0:52:22.290

After experiencing the contingencies for responding in terms of the rule, select the one that is the most sane. The coherence clusters are still high mass networks, whereas we see some shuffling in the incoherence group, where finally the letters are starting to sort into their experimental categories and so too are the symbols, but still nowhere near the mass of our coherence group, so the contingencies can move it, which is cool. 0:52:23.790 –> 0:52:53.620

Then, after our contingency shift, we finally start to see a weakening of the coherence network. But the details matter. The density of the letter relations are still high. This part of the network remained resistant. However, the symbols that only recently joined the network are now in flux. On the other hand, the coherence network appears to have essentially rebounded to the pre experimental relations. So did we just stumble on a phe-

nomena that’s already established in behavioural momentum? 0:52:53.760 –> 0:53:5.570

Called Resurgence in the absence of reinforcement for relating to things in a new way, you respond in terms of prior relations that existed before the contingencies operated on it. 0:53:6.700 –> 0:53:21.520

So these results were not what we were expecting at all. We thought that the high density rule would be more resistant to the contingency shift. Instead it was as if the high mass group was actually more flexible to the shift. 0:53:22.480 –> 0:53:34.170

I think there’s a clear reason why, though, and we might have also accidentally stumbled across a sort of relational entanglement that is showing up in other studies as well. So let’s break this down a little bit more. 0:53:34.970 –> 0:53:35.530

Um. 0:53:36.870 –> 0:53:45.40

Remember this equation. So let’s treat our response as if it’s a network. This makes sense, given networks are comprised of relational responses. 0:53:45.740 –> 0:54:14.210

If the two networks are the same mass, then there’s an equal probability that responding will occur in either network A or B. Well, we can wait this outcome by either increasing the massive network a like in our coherence condition and reinforcing responding in terms of a like in our contingency shift. Something like this. Now, when the contingencies flip, it should be more difficult to make the shift for the high mass coherence group, at least in theory, but that’s not what happened. 0:54:15.650 –> 0:54:41.180

But consider that in this case, responding in terms of network B is actually the opposite of a. Remember the reinforce contingency shift was to select the least related instead of the most related. So what’s being reinforced is to do the opposite. So when we increase the relational mass of a, we’re also increasing the relational mass of B because B exists as the opposite of a. 0:54:41.880 –> 0:55:7.210

So here’s where things get tricky. As the new contingency

pulls the response closer to B, and if B is also a high mass network, that is the opposite of a. Then once R hits a threshold, it should rapidly accelerate towards B, producing an even more flexible response. Essentially, we should expect that the person might be able to switch rapidly between networks A and B depending on the context. 0:55:8.540 –> 0:55:18.330

This is actually incredibly important without considering the mass of other networks, it would be tempting to assume that the more you know about something, the more resistant it is to change. 0:55:19.220 –> 0:55:49.310

But when those things are related or entangled in other ways, it might actually make relational responding even more flexible. So how do we foster flexible responding, establish multiple relations that operate in multiple and complex ways, essentially building relational repertoire that are highly adaptive in context or psychologically flexible. So This is why this outcome, which we were not expecting, but what we're seeing in terms of things like emotional experiences as well. 0:55:49.570 –> 0:56:6.80

Is so critically important as we start to approach challenges related to mental health. Flexibility matters in our initial conceptualization of what that might be from a density perspective was wrong and requires understanding entanglement to some extent, which we're still unpacking. 0:56:7.750 –> 0:56:33.450

So a common question that we get is why do we have all of these equations? Why is there a need for a theory extension like RDT? Well, RFT is often described in narratively or in a technical notation. This works fine when relational networks are relatively small and the dimensions are limited to only a few C rails. This notation here is a three member network in one singular context. 0:56:34.330 –> 0:57:4.180

However, what happens when we build to 18 stimuli that are related across multiple dimensions? The notation would take up the whole screen and it would be impossible to interpret, and although it's predicted entailments may be logical to a computer that can hold all of this information, our experiments show that

the exact relations may not hold at this level of complexity, and it is more so. These higher order patterns or the essence of the relational responding that remains at complexity. 0:57:5.270 –> 0:57:12.280

Critchfield and Reed discussed the importance of quantitative models in the field of behaviour analysis for researchers at all levels. 0:57:13.170 –> 0:57:43.840

First, it provides A parsimonious shorthand once the equation is understood by the community, it can itself convey meaning without the need for excessive narrative description. For example, let’s say you’re treating clients experiencing depression or anxiety. We might find that unworkable or self. Defeating rules are highly resistant to change. How do we know? Well, because it’s pervasive. It occurs across multiple contexts, at some level, even the concept of psychopathology. 0:57:44.30 –> 0:57:56.930

Necessitates a level of stability or unworkability maladaptive behaviour that we know for humans who relationally frame likely necessitates equally rigid rule following that’s maladaptive or unworkable. 0:57:57.690 –> 0:58:20.600

Therefore, one solution given this equation is to simply increase the force of negative X or to change exposure to contingencies that might challenge the rule. For example, in behavioural activation that involves approaching previously or potentially appetitive aversive experiences, even though doing so is hard. 0:58:21.480 –> 0:58:31.380

When we do this, we’re increasing negative X as it relates to our unworkable rule in hopes that these contingencies hook the behaviour more than the relational network. 0:58:32.80 –> 0:58:44.10

Things like exposure therapy, it’s just the systematic desensitisation and so on are built to shape tolerance that can allow for even greater magnitude of negative X over time. 0:58:45.290 –> 0:58:50.280

This was developed by behaviour analysts in this huge within

acceptance and commitment therapy. 0:58:52.630 –> 0:59:22.980

Now we don't just want to expose the environment without teaching adaptive alternatives. We want to build relational repertoire as that can compete with the unworkable rule and be responded to flexibly, if not the unworkable rule, then what else do we want our clients to do? Remember, the entanglement are opposition result from the rule, government behaviour study. Psychological flexibility likely necessitates the ability to move through multiple adaptive relational repertoire and the context in order to maximise contact with valued. 0:59:23.60 –> 0:59:24.250

Sources of reinforcement. 0:59:25.220 –> 0:59:54.690

So if we simultaneously introduce clients to a contingency shift through behavioural activation while building an alternative relational network that is coached up in that context, now we're getting somewhere and we want more flexible rules to be more resistant to change such as given the passage of time or when challenges show up in new contexts and the therapist does not around, we want those flexible rules to persist despite those disruptors. How do we do it? Well, let's. 0:59:54.790 –> 1:0:24.790

Increase volume. Multiple exemplar training get out in the world, get out in the context, experience new challenges. What about density? Trained to fluency? Practise, practise. Practise over and over again. When we increase volume and density within our axe sessions, we might be able to create more flexible repertoire of flexibility or psychological flexibility. That's also more resistant than the rules that led to psychological suffering in the first place. 1:0:25.130 –> 1:0:29.760

I know that this is quite abstract, but I'll unpack it a bit more in a bit. 1:0:31.410 –> 1:1:2.70

Another question is, can we weaken the control exerted by the unworkable rule or make that unworkable rule less resistant to change? If so, not only will negative X our contingency shift be more effective, but the probability of responding in terms of psychological flexible networks that were building in therapy can

be more effective too. We can transform our equation as relational density is equal to mass over volume. Well, if we increase volume. 1:1:2.150 –> 1:1:32.630

An incoherent ways holding mass constant or reducing it. Then we might see less pull from the rule. How might we increase volume? Well, diffusion as an example. The very essence of most diffusion activities involves working with the thought and multiple and incompatible ways. Let’s sing the thought as a birthday song. Say it over and over again. Try it as a thought monster and when we do that we might see that density diminishes. The environment can then exert more present moment influence. 1:1:33.220 –> 1:1:39.970

In a sense, we’re making space for in a more literal sense for things like present moment awareness to occur. 1:1:40.990 –> 1:1:54.860

Of course, all of this is interdependent. Fields operating in a context of X or force and negative X counterforce influencing all elements of the field as the external contingencies ebb and flow. 1:1:56.860 –> 1:2:1.670

And these higher order relations are incredibly hard to describe narratively. 1:2:2.540 –> 1:2:3.650

This is the whole point. 1:2:4.410 –> 1:2:6.950

And their meaning? 1:2:8.650 –> 1:2:9.130

Sorry. 1:2:13.160 –> 1:2:14.470

They’re hard to describe, narratively. 1:2:14.790 –> 1:2:25.760

Um, their meaning is hard to discern as something literal, but becomes more literal literal when you zoom out and look at the big picture. In general, our standard equations like those that I’ve shown here. 1:2:27.230 –> 1:2:44.860

Such as the idea that relational frames might exert something similar to gravity in Newtonian mechanics. I mean, it sounds insane and it’s all good and well as far as a metaphor is concerned. But what do we do with this information beyond feeling and on perhaps a bit of dread at the immense complexity of human re-

lational responding? 1:2:45.590 –> 1:2:53.560

Well, let's break it down quantitatively again in a general equation that allows us to start to play with the elements. So what is force? 1:2:54.830 –> 1:3:25.60

Attraction is a change that exceeds the context. For example, if I have two networks that I'm trying to merge with a third network and it takes way more resources to get the second network to merge than it does the first, then we would say that the attraction between the 1st and the third has greater force because less external force or context is needed to merge the networks okay. So let's say in therapy you're doing an exercise that's not landing with your client. 1:3:25.540 –> 1:3:28.250

Something like leaves on a stream well. 1:3:29.260 –> 1:3:58.360

What's going on? Two things could be true based on our equation. First, maybe the mass of leaves on the stream metaphor as a network is too low. Maybe the person grew up in an exclusive existence in a big city and has never watched a leaf drift on a stream. It has limited meaning to them. Okay no problem. Let's switch it maybe to an aeroplane as a metaphor, since they live near an airport. Imagine attaching your thoughts to an aeroplane and watching them take off into the sky. 1:3:59.100 –> 1:4:10.550

Don't worry about where they're going. You know that thought too. You can attach it to an aeroplane and watch it take off as well. Watch it fly away and keep doing this. As you noticed, another thought show up. 1:4:12.110 –> 1:4:19.880

Another challenge might be that the distance between our metaphor network and the challenge that they're actually experiencing is too far of a leap. 1:4:20.550 –> 1:4:25.510

You're trying to use leaves on a stream to help resolve that. Your client just got fired from their job. 1:4:26.520 –> 1:4:43.620

Now notice that thought I cannot pay my rent and watch it drift away on a leaf. That's all good and well until they get kicked out of their home. The distance is too great. Between our leaf metaphor and the actual challenge. But maybe something

like a values network is closer that can start to bridge the gap. 1:4:44.370 –> 1:4:47.600

Now I get the limitations of Newtonian mechanics. 1:4:48.260 –> 1:5:18.770

In the physical sciences, it’s a starting point, yet from it we might be able to, you know, or sorry. From Newtonian mechanics, scientists and engineers have been able to build bridges and aeroplanes, and all of those things. So from a pragmatic lens, Newton is still very much the man. Unless you’re deep in spacetime or chilling like Ant man. And the quantum realm. Also, if we want to get to how networks evolve quantitatively and not just narratively, then we need units to start to build network analysis in this case. 1:5:18.860 –> 1:5:22.880

Volumetric mass density could provide us with a starting point. 1:5:25.140 –> 1:5:33.540

And at its core, the essence of all experiences may be self. Skinner defines self as the central organisation. 1:5:34.900 –> 1:5:38.810

Of all responses and the entire learning history of an individual. 1:5:39.570 –> 1:6:10.90

In act self is fundamental to interventions across a myriad of psychological challenges. It’s really hard to explain the concept of self if anyone’s familiar with the chess board metaphor. The point of it is that you are none of the pieces on the chess board. Rather you are the chess board and the pieces and the entirety of that experience that experience the point is, is that the metaphor is meant to convey the transcendence of self, the essence of observing and noticing one’s thoughts and feelings. 1:6:10.170 –> 1:6:15.680

Beyond its context are elements, all of it mediated through symbols and meaning. 1:6:17.480 –> 1:6:32.970

So I’m gonna do a really quick activity in and maybe I can get, you know, one or two responses. And if people could throw some stuff in the chat that would be great. I’ve given you a lot of content, so I wanna pause to see if we can apply these concepts

and get a bit of participation. 1:6:33.810 –> 1:6:39.560

So here we have a client who's struggling with gambling and says that they are losing everything. 1:6:40.440 –> 1:6:47.510

Their spouse wants them to stop, but is unwilling to say anything to them about it and says that's just the way they are. I'm stuck in this too. 1:6:48.160 –> 1:7:3.800

The client also wants to stop, but it seems to be fused to a rule. Everyone has their vices. This is mine. I'm only going to gamble this week to get it out of my system, and then next week I'm gonna quit. Of course, as next week never comes. 1:7:4.490 –> 1:7:19.560

So this is a behaviour analysis problem in many ways. We have clear contingencies of reinforcement, several potential functions. We have behaviour we can observe and measure. There are clearly rules within nested layers of dense relations that we need to unpack. 1:7:21.100 –> 1:7:32.400

So in the scenario I wanna focus on this specific rule, everyone has their vices. This is mine. I'm only going to gamble this week to get it out of my system. And then next week I'm going to quit. 1:7:33.500 –> 1:7:41.770

So of course we could break this down into a network analysis if we want, but I want to see if we can start to use this density thing to guide a case conceptualization. 1:7:42.930 –> 1:8:2.500

So my first question, if you wanted to try to answer it in the chat, is how could we increase counterforce or external contingencies in order to change the behaviour? And I'd love to hear from one or two people from the audience too. So how could we manipulate negative X or counterforce that's operating on this rule? 1:8:24.360 –> 1:8:28.70

To Maria, saying present new activities with without asking him to stop. 1:8:24.770 –> 1:8:28.660

To Maria, saying present new activities with without asking him to stop. 1:8:29.670 –> 1:8:44.610

OK, great. Yeah. What other what other repertoire or activities are available other than gambling for him to engage in? And what are the contingencies of reinforcement that operate on those alternative responses? Good. Yeah, we’re increasing X for the alternative activities. 1:8:45.600 –> 1:8:47.320

Hmm. DRA style. Love it. 1:8:48.30 –> 1:8:49.20

What’s one more example? 1:9:3.160 –> 1:9:4.800

Okay make it harder to. 1:9:4.110 –> 1:9:6.710

Michael is having increasing response out of gas. 1:9:8.160 –> 1:9:29.320

Increase their response effort of gambling itself. Yeah, perfect. Absolutely. Maybe there’s a set amount of money that is set aside and he has to engage in some kind of additional behaviour and organ to access the gambling money. Yep. That’s a perfect example of throwing in a disruptor. It’s not perfect, but it could disrupt the process. And what about his spouse? 1:9:33.550 –> 1:9:46.110

They seem to be enabling it as well, um, and so is there an element of adjusting their behaviour to also serve as a bit of a disruptor? They seem to be passively okay with it, but we’re not sure how long that will last. 1:9:46.940 –> 1:9:48.150

Okay next question. 1:9:51.720 –> 1:10:4.30

How could we decrease mass or resistance to change of their rule so they gave you this rule? They believe it to be true and it’s high mass. How could we decrease its mass? 1:10:32.530 –> 1:10:35.620

Through some diffusion exercise, I guess you could. 1:10:36.700 –> 1:10:37.100

Chest. 1:10:39.750 –> 1:10:44.220

Note these on having the thought that whatever or. 1:10:47.590 –> 1:10:47.870

Yep. 1:10:47.300 –> 1:10:47.950

See what I mean? 1:10:48.800 –> 1:11:6.470

I do. Yeah. Exactly. So we can, you know, create a diffusion exercise that increases the volume. And if we're doing it in a non coherent way, then it should not add to our density or mask. And so we can maybe reduce the influence of that specific rule. Awesome. Good. 1:11:7.230 –> 1:11:14.800

Okay. And then the last question is how might we build a competing relational network or rule that has more mass? 1:11:23.970 –> 1:11:24.70

The. 1:11:25.570 –> 1:11:55.580

And I'll I'll jump in on this one. Just in the interest of time. One example that I think of is maybe we build the values network to have greater mass as something that can compete. And so I'm at the casino, I'm thinking about how I'm getting this out of my system, all of my relational framing is really based on that negative reinforcement contingency. How am I going to feel okay later? But what if I can get those values to show up psychologically in the moment at the point of gambling? What if I can think about my wife, my kids, if I can think about? 1:11:55.710 –> 1:12:26.320

Um, that I'm spending my kids educational money or college tuition at the casino today and that my wife is gonna leave me if I keep doing this. If I can get that stuff to start to show up at the moment of gambling, and also then those appetitive functions as well. Starting to think about how my life will be different if I can just walk away right now and bring those contingencies into the psychological present. So we wanna build volume and density and practise it in session so that when we're at the point of playing the slot machine. 1:12:26.400 –> 1:12:31.800

That those events are showing up psychologically or even before that at the point of choosing where to spend the day. 1:12:32.700 –> 1:12:33.910

So it's not perfect. 1:12:34.430 –> 1:12:45.830

Um by any means, but it's a starting point of how we're trying to take this relational density theory stuff and apply it to case conceptualization to deal with mental health. We're at a starting

point. 1:12:46.960 –> 1:13:5.350

We very recently published A clinical case study where we used density theory as a conceptual framework to develop an intervention. I wanna walk through the study really quickly, but it kind of shows how we’re operating this framework. So this study was implemented with a young adult male. 1:13:5.630 –> 1:13:30.600

Um diagnosed with autism, bipolar disorder and schizophrenia. They had high scores on the peak comprehensive assessment that indicated that they had a strong relational repertoire. They were attending a specialised school. They had high rates of aggressive behaviour and therefore had difficulties getting accepted into a residential facility. They were currently living with their mom but expressed a value of being more independent and eventually moving out of their home. 1:13:31.600 –> 1:14:2.410

And so in this study, we did a series of assessments. We did an open-ended functional assessment interview questions about behaviour, function, child Psychological Flexibility Questionnaire and the Avoidance Infusion Questionnaire. So I put these in here only because they’re fairly standard assessments that we already use. So we don’t need to reinvent the wheel. What are these assessments getting at from a density analysis? Well, the FAI and the QB are giving us information about acts and negative X. 1:14:2.490 –> 1:14:15.170

What are the external contingencies that might maintain the external and relational behaviours that are challenging as well as maintain the external or sorry, the relational behaviours that participate with them? 1:14:16.820 –> 1:14:31.830

The child’s psychological Flexibility Questionnaire and the avoidance and Fusion Questionnaire give us some information about relational mass. So how resistant are the flexibility and inflexibility networks going to be to change? 1:14:33.0 –> 1:15:0.820

And if we view it this way, let’s attack both so we can attack negative X, for example by creating contingency contracting. So in this case, the participant earned access to their community to

support greater autonomy in a stepwise fashion as they met conditions in their contingency contract. And as points were earned throughout the day, both for external behaviour as well as identifying act processes within their own behaviour. At the end of the day. 1:15:2.280 –> 1:15:21.20

Then we can target relational mass, for example doing twice weekly act lessons guided by the AIM curriculum, and these were delivered over telehealth by very highly trained rbts and equally targeted. All six of the core processes of the Act hexaflexagon. 1:15:22.120 –> 1:15:51.830

In addition, in order to create more relational mass, all elements of the intervention, including the contingency contract as well as the ACT lessons were Star Wars themed. He was a huge Star Wars fan towards moves where the light side of the force away moves where the dark side of the force, positive and negative feelings are both OK, but we cannot give in to anger and hate and become aggressive. We simply have to notice it, sit with it, identify our values and move towards the light side of the force and the moment. 1:15:52.270 –> 1:16:7.940

One example of a themed aim lesson involved using the force to lift an X wing out of a swamp on Dagobah. Committed actions were the force and he had to come up with several alternative examples of committed action at a fluent enough rate to get the ship out of the swamp. 1:16:8.620 –> 1:16:19.450

Adding this component was to support greater coherence between the experiences and the aim lessons and Star Wars, which was already a high mass, positively valenced relational network. 1:16:20.520 –> 1:16:51.660

And the results are what you see in the behaviour analysis studies. So as far as percentage of school day in which he was aggressive, we see that was around 231:16:51.740 –> 1:16:52.190

Pants. 1:16:52.930 –> 1:17:22.880

And we see reductions in psychological inflexibility overtime. So we can infer that the relational networks that occurred along with aggressive behaviour were reduced in mass. That allowed

the other elements of the intervention, such as our contingency contract as well as the naturally occurring contingencies to become more powerful in the environment to exert more influence. What’s more important is that because of this intervention, he was accepted into a residential facility to support his independence and. 1:17:22.960 –> 1:17:28.830

Autonomy and where he was living during the one year follow up and is still living today. 1:17:31.480 –> 1:17:46.690

The next data set that I want to show you, um, is that we’re trying to figure out how to assess these processes more directly from a density model. So instead of just reinterpreting our current frameworks, how can we start to invent new technologies that can operate in these spaces? 1:17:47.390 –> 1:18:10.240

So this study was conducted by Doctor Palomas and her lab recently evaluating the role of relational responding in the psychological flexibility of college students. So they recruited 30 undergrads and sorted the students into high and low flexibility groups based on their scores on the personalised psychological flexibility index in the context of. 1:18:10.330 –> 1:18:28.340

And an educational goal. Relational responding was measured again using the multidimensional scaling procedure similar to those that you’ve seen so far. The participants generated some of their own stimuli, including values, strengths, and interests and challenges and thoughts and feelings that they have in their context. 1:18:29.20 –> 1:18:40.550

And we also gave them preset stimuli that included six positive and negative affect terms from the PA Annas, and we also included the dialectic stimulus me here now. 1:18:46.720 –> 1:19:13.230

And so the results are pretty telling for the low flexibility group. What we see is that me here now is closely related to the negative affect network stimuli as well as my challenges and my problem behaviours in tightly fused to my emotions and thoughts in the high flexibility group, we see the opposite me here now is more closely related to the positive affect network. 1:19:13.350

–> 1:19:17.800

And is closely related to my educational goals, strengths and interests. 1:19:18.690 –> 1:19:27.160

And less related to my emotions and thoughts, even though my emotions and thoughts are also drifting closer to the positive network. 1:19:28.230 –> 1:19:31.120

In any case, what these data suggest? 1:19:31.780 –> 1:19:40.350

Are that there are higher order relational patterns within the relational field that participate in the concept of psychological flexibility? 1:19:41.250 –> 1:19:45.100

That plays an important role in our ACT based intervention. 1:19:47.220 –> 1:20:0.900

So I know that I'm running short on time. We have 5 minutes left, but I want to make sure that I take a moment to address something that I believe is immensely important when we're talking about mental health from a behaviour analytic lens. 1:20:2.20 –> 1:20:10.700

Relational density theory provides A theoretical framework to understand relational behaviour in an interdependent way that operates in a context. 1:20:11.410 –> 1:20:16.820

But it's important to understand that this context also itself operates in a context. 1:20:18.0 –> 1:20:35.750

Cultural contingencies, or meta contingencies, create the conditions in which the contextual contingencies operate on each individual. The contingencies of reinforcement and punishment that lead to poor mental health themselves operate within larger and more extended cultural contingencies. 1:20:36.570 –> 1:20:41.40

And we live in a culture that experiences exceptionally poor mental health outcomes. 1:20:41.840 –> 1:21:3.890

Research on adverse childhood experience tells us that living in a world that limits punishment and maximises reinforcement with respect for childhood development can reduce or even eliminate many of the social and mental challenges that we face

today. And yet poverty and violence persists in our society today, and coercion abounds as the primary mode of altering human behaviour. 1:21:5.150 –> 1:21:14.100

Moreover, meaning emerges from within cultural contingencies, propagated through language pervasive in the very ways we’ve been taught to view our world. 1:21:15.30 –> 1:21:18.100

That the way that things are today ought to be so. 1:21:18.880 –> 1:21:20.610

The idea that it is what it is. 1:21:22.250 –> 1:21:24.140

But for many, what it is is suffering. 1:21:24.910 –> 1:21:26.340

And for some more than others. 1:21:27.210 –> 1:21:45.80

The only way to truly support mental health on a broad scale is to work towards what Tony Biglin described as a more nurturing society, more nurturing communities, and that requires expanding this science to a next level that goes beyond these immediate contingencies that we all face. 1:21:46.950 –> 1:21:58.560

Now this stuff has been around for a while, but as noted by Hammond, Farran Rodriguez, there are substantial agreement among behaviour analysts that cultural practises are conditioned by social or verbal influence. 1:21:59.310 –> 1:22:17.30

That is to say, not only the external contingencies operate on a group that influence the group, but there are long standing symbolically mediated traditions or a cultural milieu that includes things like shared beliefs, morals, material resources, competition, governance, government policies, and so on. 1:22:17.850 –> 1:22:33.10

The cultural milieu is the very essence of the culture itself. In our terms, the MAYU can be understood as the relational mass operating at a cultural level comprised of the relational behaviour of many behaving people within complex systems. 1:22:36.110 –> 1:22:51.290

The history of behaviour analysis doesn’t start with Skinner. There’s a depth of intellectual thought that precedes Skinner, upon which the initial conditions of behaviour analysis were

formed. Behaviour analysis is one of many subgroups developed from American pragmatism. 1:22:51.990 –> 1:23:1.880

The central argument is that we cannot know the truth and science is wasting his time attempting to do so. The search for some greater truth beyond experiences led to more suffering than it has good. 1:23:2.500 –> 1:23:9.730

Instead, we should seek out scientific principles that allow us to work better in our world today than yesterday and better tomorrow than today. 1:23:10.410 –> 1:23:13.880

But no better as idealised in the sense that we will never achieve it. 1:23:14.520 –> 1:23:16.870

Will never achieve best, only better. 1:23:18.110 –> 1:23:31.950

Also, what is best is both contextual and culturally defined. Sadly, what is considered best for the ruling class is what is generally taken as best by the broader society and with disastrous implications for minority groups. 1:23:32.910 –> 1:24:3.980

Given the emphasis on context, American is used here to denote that this particular brand of pragmatism arrived at and is embodied in the Americas. Spencer notes that the concept of pragmatism is deeply enmeshed within many indigenous belief structures, emphasising the role of context and generation and the selection of behaviour. The propagation of ideas through symbols James and Pierce are given credit for this, but from pragmatism is the idea of philosophical dough. We should question the dogmatic rules that were given as truths. 1:24:4.250 –> 1:24:8.170

Test those truths, examine their ability to change the world in some way. 1:24:8.940 –> 1:24:31.850

In the United States, it should come as no surprise that these essential or elemental truths came mostly from religious doctrines. That, as it happens, largely benefited white people and men, and led to the oppression of women and people of colour born from pragmatic thought were the waves of feminism that challenged the social construction of womanhood and the pragmatic utility of oppressing just over half of the population. Is this

beneficial? 1:24:33.180 –> 1:24:45.340

To things like critical race theory that posited that racism is rooted deeply within our shared historical context, and although we cannot change this history, we can act now to influence its future. 1:24:46.180 –> 1:25:0.530

So in this way, pragmatism can be viewed as the opposite of colonialism, colonialism, the act of acquiring full or partial control of territory and acting policies, and exploiting its people. Economically. Exceptionalism, the belief that our culture knows best. 1:25:1.500 –> 1:25:18.410

In some ways, what we’re learning in our translational research and RDT can contribute to a pragmatic understanding of complex relational behaviour as it exists within cultural context. Ideally, this should be focused on dismantling colonialism and contributing to these mental health challenges in our world. 1:25:19.370 –> 1:25:29.340

Um, so there’s a lot more to go through and not a lot of time. I know we have some questions, so I’m gonna get out of the way, but I want to leave you with. 1:25:30.310 –> 1:25:30.790

This. 1:25:32.200 –> 1:25:33.810

So as a field. 1:25:34.610 –> 1:25:37.190

What is our meaning and what is our essence? 1:25:38.20 –> 1:25:39.550

What is our cultural milieu? 1:25:41.50 –> 1:25:57.360

What are the dense, voluminous multiply related networks that influence our behaviour as clinicians and scientists for Skinner, meaning and understanding we’re at the heart of self and self-control here. Now we have the ability to control our own futures and to define our own meaning. 1:25:58.440 –> 1:26:3.710

Some of you may choose to be amazing clinicians and save the world one person at a time. Do that. 1:26:4.450 –> 1:26:10.850

Some of you might choose to become fantastic researchers, scientists, discovering deep truths about the human condition. Do it. 1:26:11.830 –> 1:26:19.310

Determine what all of this means to you and your history, and what this information that you've learned today might mean for your work to Morrow. 1:26:20.200 –> 1:26:26.550

And deep down, as a field, what is our essence as behaviour analysts as behaviour scientists? 1:26:27.260 –> 1:26:29.970

Well, let's choose to be essentially good. 1:26:30.720 –> 1:26:53.550

To be progressive, to be affirming and not denying of experiences, to be pragmatic, and to put the needs of society, especially of those most harmed by it, at the forefront of our research. There's nothing wrong with them. Mental health is not, as does not signify, some deficiency of the individual. It signifies A deficiency of the society that surrounds them. 1:26:54.700 –> 1:26:55.560

We need to change it. 1:26:56.580 –> 1:26:58.950

Let us choose to be essentially human to start. 1:26:59.610 –> 1:27:3.250

And achieving our desired meaning and purpose in the world will follow. 1:27:4.350 –> 1:27:4.780

Thank you. 1:27:8.570 –> 1:27:8.650

The. 1:27:16.240 –> 1:27:20.670

Thank you so very much for this talk. That was really good, I guess. 1:27:15.770 –> 1:27:27.300

Thank you so very much for this talk. This was really, really good. I guess we we showed move on to the next link and have the panel discussion now in the new link there, right? So I'm just going to shutdown this call.

2. Book of Abstracts

2.1 Moser et al.

Relational Framing of International Students in the United States and Willingness to Engage: An Exploratory Density Analysis

Ryan Moser, Jordan Belisle, & Dana Paliliunas
MISSOURI STATE UNIVERSITY

ABSTRACT: Universities in America are some of the most diverse areas in the country, offering ample opportunities for intercultural interaction. However, literature indicates that this is not always the case. Positive cross-cultural interaction provides students with invaluable skill development that will benefit them not only in school and their future career being culturally literate, but also benefit the building of an inclusive society (Fozdar 2016). While many studies focus on what factors need to be in place for positive cross-cultural interaction to occur, the current study examines the aspect of approachability. By using the multidimensional scaling procedure in Relational Density Theory (RDT; Belisle & Dixon, 2020), we will evaluate the complex relations between cultures from around the world with approachability characteristics: Sociable, Sincere, Friendly, Trustworthy, Threatening, Defensive, Incompetent, and Unfriendly. RDT is utilized to help conceptualize resistance to interact with unfamiliar cultures compared to more familiar cultures. Cultures chosen for study were from among countries that frequently send international students to the United States; participants were also asked to complete a willingness scale, rating their willingness to interact with each specific culture. Results show significant clusters of high density with Northern American countries

RDT: Relational Density Theory.

and favorable perceptions of approachability. The willingness to engage with North American cultures was higher compared to cultures from other regions. Furthermore, individuals who had never traveled abroad exhibited greater openness to interact with North American countries compared to those who had previous international experiences who showed a stronger inclination to engage with countries farther away from America compared to those who hadn't traveled. Notably, the countries that ranked lowest in terms of willingness, aligning with the negative characteristics in the multidimensional scaling (MDS), were the primary sources of international students for the United States.

MDS: Multidimensional Scaling.

KEYWORDS: Cross-cultural interaction, approachability, prejudice, relational density theory, multidimensional scaling, college students, international students

Cite this abstract:
Moser, R., Belisle, J., & Paliliunas, D. (2023). Relational Framing of International Students in the United States and Willingness to Engage: An Exploratory Density Analysis. **In** de Almeida, R. V., & Hall, K. (Eds.). *Proceedings of the Conference on Ætiological Approaches of Mental Health Conditions: Network Analysis and Relational Frame Theory* (pp. 111–112). Ulster University, Coleraine, Northern Ireland. DOI: 10.XXXX/XXXXXXXX

2.2 Campbell et al.

Relational Density Theory: Further Exploration of Coherence Between Classes

Mikayla Campbell[1], Caleb Stanley[1], & Jordan Belisle[2]
[1] UTAH VALLEY UNIVERSITY
[2] MISSOURI STATE UNIVERSITY

ABSTRACT: Relational Density Theory is an extension of Relational Frame Theory that attempts to model or describe high-

order interactions within relational behavior by utilizing Newtonian classical mechanics from physics as a quantitative metaphor. Greater mass networks (high volume and density) are more resistant to change. The purpose of this study was to evaluate the relative degree of change of a pre-established low volume-high density relational class when exposed to a strategic disruptor. Participants were either assigned to a coherence group or a disruptor group where they completed a Qualtrics survey with various training videos and subsequent questions regarding the relation of stimuli. We found that this strategic, randomized disruptor was not enough to produce changes in the pre-established relational network. Participants relied on their pre-established knowledge of the relational class rather than changing their responses based on the disruptor. Future research may explore the degree of strength required for a disruptor to produce changes in such responding.

KEYWORDS: Relational Frame Theory, Relational Density Theory

Cite this abstract:
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2.3 Zuch et al.

`A Pilot Investigation for the Coherence of Relational Frames Underlying Autism Stigma`

Claire Zuch & Jordan Belisle
MISSOURI STATE UNIVERSITY

ABSTRACT: The autistic community disproportionally experiences

a high rate of stigmatization, prejudice, and discrimination from those in society (Turnock et al., 2016). This study sought to evaluate the strength of relational frame surrounding autism and stigma and be a preliminary study on the disruption of these frames. 24 college students enrolled in an undergraduate psychology course participated in the present study. Participants completed two pre-test measures, the Multidimensional Scaling Procedure (MDS) to assess stigmatizing beliefs held towards autism and novel names and an assessment of biased preference responding towards autistic individuals. Narratives describing of two autistic individuals were instructed to be read and then a series of names and either the label of autistic or non-autistic through a Stimulus Pairing Observation Procedure (SPOP) was presented. Through random assignment, participants completed either a SPOP that paired the names with facts centered around deficits of autistic individuals or the strengths of autistic individuals. To assess a change in relational frames surrounding autism, a post-test MDS was administered as well as the assessment of biased responding. Results demonstrated that those who received the information regarding strengths had higher coherence of stigmatized relational frames surrounding autism. Implications suggest people have strong existing relational frames around autism and when new information is added to their network about an autistic person it is being evaluated through those existing frames instead of disrupting them. [*Attachments to this submission: Figures 2.1, 2.2, 2.3 (pp. 122–123).*]

SPOP: Stimulus Pairing Observation Procedure.

KEYWORDS: Autism, Stigmatization, Biased Response, Relational Density Theory

Cite this abstract:
Zuch, C., & Belisle, J. (2023). A Pilot Investigation for the Coherence of Relational Frames Underlying Autism Stigma **In** de Almeida, R. V., & Hall, K. (Eds.). *Proceedings of the Conference on Ætiological Approaches of Mental Health Conditions: Network Analysis and Relational Frame Theory* (pp. 113–114). Ulster University, Coleraine, Northern Ireland. DOI: 10.XXXX/XXXXXXXX

2.4 Rawers et al.

`Analysing Cross-Cohort Differences in Socioeconomic Position and Mental Health Using Latent Class Analysis`

Caitlyn Rawers, Eoin McElroy, Orla McBride, & Jamie Murphy
ULSTER UNIVERSITY

ABSTRACT: Early life socioeconomic disadvantage is a robust predictor of poor mental health, particularly for children and adolescents. However, there are numerous indicators of socioeconomic position such as income, education, or social class, which are differentially related to specific mental health outcomes. Thus, findings regarding socioeconomic inequalities in mental health vary significantly. Using multiple socioeconomic indicators allows researchers to investigate the multi-dimensionality of socioeconomic position as a construct, but presents challenges for regression-based analyses following mutual adjustment. Person-centred approaches, such as latent class analysis, can be used to identify distinct patterns of socioeconomic indicators and predict mental health outcomes. Yet, in addition to the heterogeneity caused by disparate indicators, evidence also suggests that the relationship between socioeconomic position and mental health are changing over time. In order to conduct valid comparisons across cohorts, retrospective harmonisation is necessary to ensure disparate measures were not interpreted differently by the cohorts. This research aims to conduct cross-cohort comparisons using harmonised adolescent mental health outcomes and latent

class models in three British birth cohorts.

KEYWORDS: longitudinal studies, retrospective harmonisation, latent class analysis, mental health outcomes, socioeconomic position

Cite this abstract:
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2.5 Vickroy et al.

Predicting Relational Learning Outcomes following PEAK Instruction with Autistic Learners: A Systems Analysis

Stephanie Vickroy[1], Lindsey Holtsman[2], Jordan Belisle[1], Mark Dixon[3], Shelby Blecha[1], & Claire Zuch[1]

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[2] EMERGENT LEARNING CENTER
[3] UNIVERSITY OF ILLINOIS, CHICAGO

ABSTRACT: The *Promoting the Emergence of Advanced Knowledge* (PEAK) Relational Training System (Dixon, 2014-2016) provides an assessment and curriculum evaluating verbal and relational learning abilities. The PEAK Comprehensive Assessment (PCA) is a standardized direct assessment of verbal operant learning, equivalence-based learning, and relational learning across each of the relational frame families. The PCA is the direct assessment of language and cognitive development in the field of Applied Behavior Analysis (ABA) utilizing multiple modalities of learning. In the current study, we assessed each of these learning

PEAK: Promoting the Emergence of Advanced Knowledge Relational Training System.

PCA: PEAK Comprehensive Assessment.

ABA: Applied Behaviour Analysis.

modalities with 60 autistic learners upon receiving ABA services, ranging from 4h per week to 30h per week. Services were implemented by behavior technicians and supervised by behavior analysts at the master's and doctoral level, and instruction was delivered using all PEAK modules. Pre-post analyses revealed significant increases in performance following 6-months of intervention across each module, where many target skills were not directly targeted supporting an emergent learning paradigm. Results also showed that outcomes were highly individualized, with age and amount of service as relatively weak predictors of intervention outcome. We discuss the results within a person-centered planning intervention framework to promote individualized services for autistic learners at a systems-level. [*Attachment to this submission: Figure 2.4 (p. 123).*]

KEYWORDS: Relational Learning, Promoting the Emergence of Advanced Knowledge, PEAK Comprehensive Assessment, Autistic Learners

Cite this abstract:
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2.6 Hall et al.

`Social categorisation and stimulus equivalence: The disruptive effect of novel socially loaded stimuli`

Keelan Hall, Mickey Keenan, & Stephen Gallagher
ULSTER UNIVERSITY

ABSTRACT: Within equivalence literature, it has often been reported that the inclusion of meaningful (or socially loaded) stimuli can enhance the likelihood of equivalence responding. However, several studies have demonstrated that if multiple, incompatible, socially loaded stimuli are included within the stimulus set, such responding can be disrupted. A series of experiments explored the disruptive effect of socially loaded stimuli on the emergence of equivalence responding within a Northern Irish context. Participants were trained to establish baseline relations between socially loaded and abstract stimulus sets using a linear series match-to-sample procedure. Initially, participants were trained to relate stereotypical 'Catholic' names to nonsense syllables, and then to relate those nonsense syllables to stereotypical 'Protestant' symbols. During subsequent tests for emergent equivalence relations, the 'Protestant' symbols presented during the baseline training were presented as samples while two 'Catholic' names which had also been used during the baseline training were presented along with a previously unseen 'Protestant' name were presented as comparisons. The results showed that the 'Protestant' names heavily disrupted equivalence responding during the initial emergent relations test, whereas during subsequent tests which removed the novel stimuli, equivalence responding was largely undisturbed. Moreover, when the novel stimuli were reintroduced, the rate of equivalence responding remained high, yet the proportion of incorrect responses accounted for by novel stimulus selections mirrored the effect during the initial tests with novel stimuli included. Results are discussed in terms of stimulus control and social categorisation.

MTS: Match-to-Sample.

KEYWORDS: stimulus equivalence, social categorization, single case design, MTS, human

Cite this abstract:
Hall, K., Keenan, M., & Gallagher, S. (2023). Social categorisation and stimulus equivalence: The disruptive effect of novel socially loaded stimuli. **In** de Almeida, R. V., & Hall, K. (Eds.). *Proceedings of the Conference on Ætiological Approaches of Mental Health Conditions: Network Analysis and Relational Frame Theory* (pp. 117–118). Ulster University, Coleraine, Northern Ireland. DOI: 10.XXXX/XXXXXXXX

2.7 Reid et al.

`The effect of social labels on the allocation of resources among equivalent stimuli: The apple strikes back`

Dean Reid, Keelan Hall, Mickey Keenan, & Robert Bones
ULSTER UNIVERSITY

ABSTRACT: Two experiments measured the effects of a social label on the distribution of resources among two three-member equivalence classes (A1, B1, C1 & A2, B2, C2) comprising nonsense syllables. Across a number of conditions, a social label was trained to C2 (YIM). The social labels described YIM as either 'GOOD', 'BAD', or 'NEITHER GOOD NOR BAD'. Participants then were instructed to distribute tokens to each of the six stimuli; the sequence of exposure to the social labels varied across experiments. Results showed that the label trained influenced the distribution of tokens, with 'GOOD' resulting in Class 2 receiving the most tokens; YIM received the most tokens in this class. When the label for C2 was 'BAD', Class 1 received more tokens than Class 2. The 'NEITHER GOOD NOR BAD' label resulted in equal distributions of tokens between classes. Across experiments, the sequence in which the social labels were trained had no significant effect on the transfer of function within Class 2. Results are discussed regarding the transfer of function in equivalence classes and its potential use in experimental social psychology.

KEYWORDS: stimulus equivalence, social label, distribution of resources

Cite this abstract:
Reid, D., Hall, K., Keenan, M. & Bones, R. (2023). The effect of social labels on the allocation of resources among equivalent stimuli: The apple strikes back. **In** de Almeida, R. V., & Hall, K. (Eds.). *Proceedings of the Conference on Ætiological Approaches of Mental Health Conditions: Network Analysis and Relational Frame Theory* (pp. 119–120). Ulster University, Coleraine, Northern Ireland. DOI: 10.XXXX/XXXXXXXX

2.8 Lee et al.

Supporting LGBTQIA2A+ College Students: Psychological Flexibility and Promoting Verbal Behavior of Support and Inclusion

Breanna Lee & Dana Paliliunas
MISSOURI STATE UNIVERSITY

ABSTRACT: The current project includes two studies that account for aspects of LGBTQIA2S+ experiences in the United States. The first study explored verbal behavior involved in stereotyping. Expanding upon Relational Frame Theory, Relational Density Theory (RDT; Belisle & Dixon, 2020) offers a model for conceptualizing relational strength of environmental stimuli, such as those contributing to stereotypes based on sexuality. Participants in the first study completed a multidimensional scaling procedure using an RDT framework by rating the degree of relatedness between stimulus pairings. Stimuli included a series of sexualities (e.g., gay man), as well as adjectives (e.g., masculine). A brief Acceptance and Commitment Therapy (ACT; Hayes, 2004) based defusion exercise was utilized to weaken relational classes involved in stereotyping. Participant responses at Time 1 indicated that straight men are perceived as more

natural, realistic, masculine, monogamous, and athletic compared to straight women, gay men, lesbian women, bisexual men, and bisexual women. After completing a defusion intervention, changes were observed in relational classes in which all identity stimuli were seen as highly related to one another. Results of this research illustrate systems of androcentrism and heteronormativity that have great impact on the well-being of marginalized groups in the U.S. The second line of research in this thesis explored experiences of well-being in LGBTQIA2S+ college students enrolled at a Midwestern university in the U.S. This correlational procedure indicated that LGBTQIA2S+ students reported lower psychological flexibility, student well-being, self-compassion, perceived social support, and GPA when compared to non-LGBTQIA2S+ students. Both of these studies highlight a significant need for more initiatives involving support and inclusion for LGBTQIA2S+ individuals involving efforts at all levels of high-impact systems such as universities.

KEYWORDS: LGBTQIA2S+, stereotypes, sexual orientation, gender identity, relational frames, relational density, Acceptance and Commitment Therapy, defusion, social support, inclusion

Cite this abstract:

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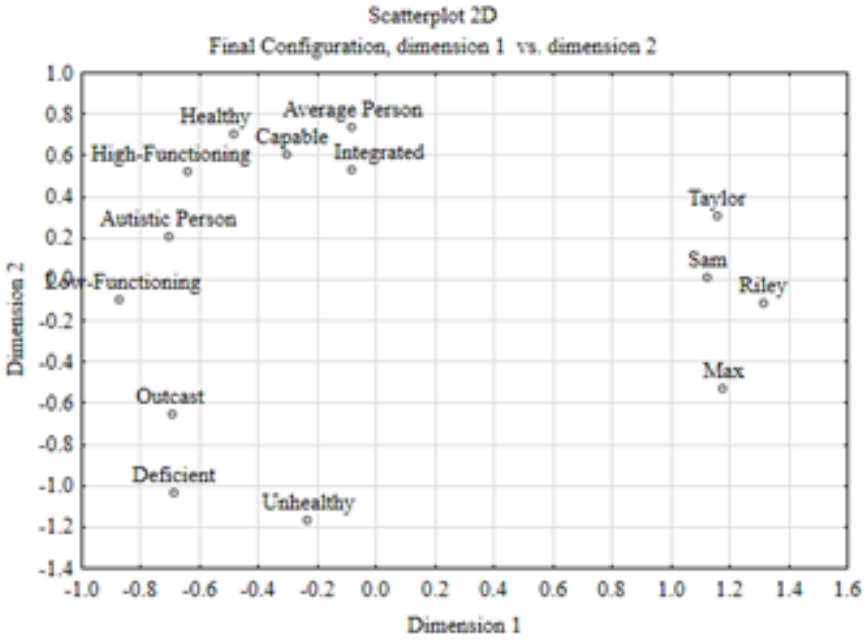

Figure 2.1: Pre-Test MDS

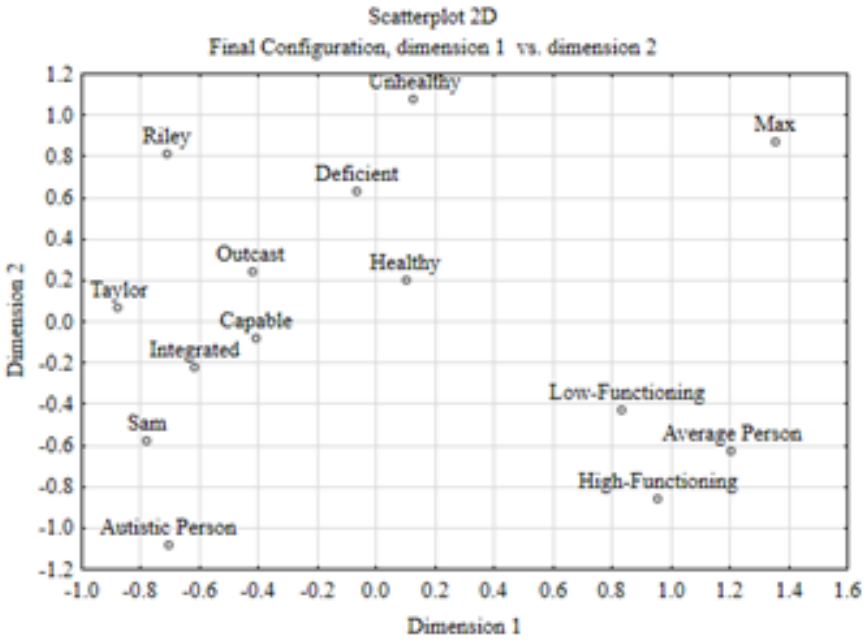

Figure 2.2: Post-Test MDS: Control Groups

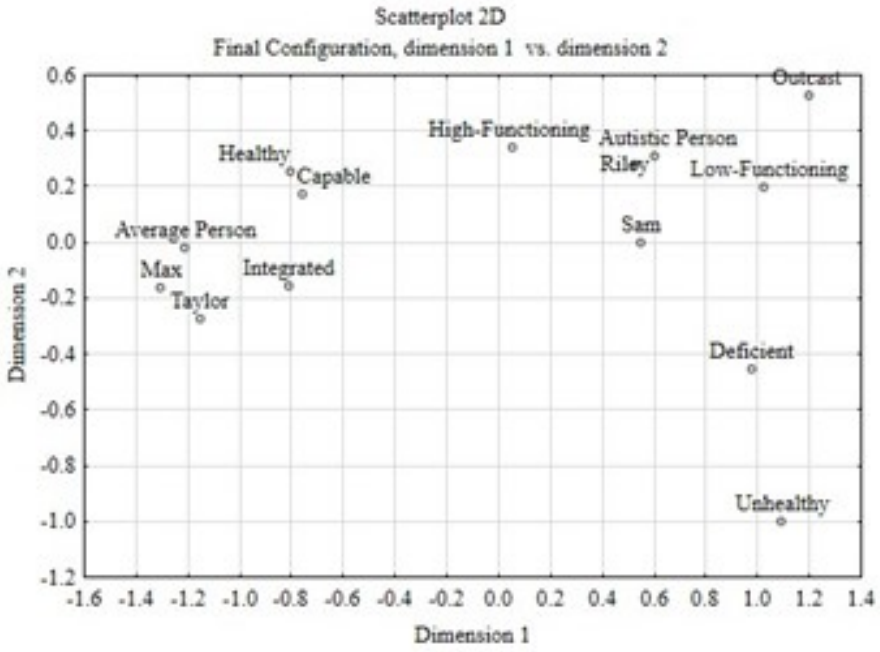

Figure 2.3: Post-Test MDS: Experimental Groups

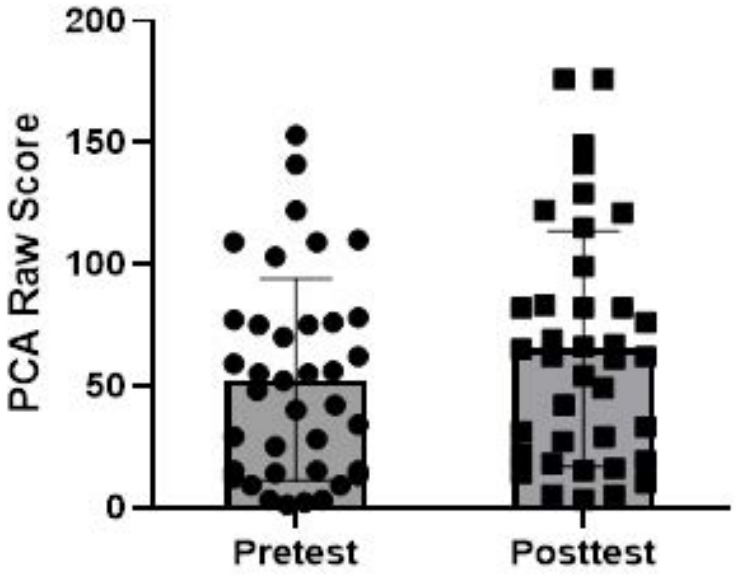

Figure 2.4: Raw pre-test and post-test outcomes for all participants on the PCA following 6-months of PEAK intervention.

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The present Conference would not have been possible without all the operational, administrative, and academic support of the School of Psychology. In special, we would like to thank our administrative officers, Donna Taggart for her valuable assistance with all administrative and operational procedures, and Francesca McClean for issuing all the certificates.

Thank you, Donna Taggart and Francesca McClean!

We need to emphasise our appreciation for the work of the research director, Prof Victoria Simms, and the postgraduate tutor, Dr Olra McBride. The whole idea of the conference started when Vic and Orla held the PhD student's induction into their second or third years in the summer of 2022, when Keelan and I were starting our second year of the doctoral programme. In that meeting, Vic proposed to hold a small conference led by PhD students-researchers. When I heard the idea posed by Vic, I immediately started to think about how I could help. I brought the project to the PhD committee, and the committee passed my proposal to organise the event with Keelan.

Thank you, Prof Vic Simms and Dr Orla McBride!

The proposal was to put Relational Frame Theory (RFT; Hayes et al., 2001) and Network Analysis in dialogue. This seems particularly important because it allows to address the difficult problem of ætiology in psychopathology. We currently have way too many frameworks for the description of symptoms and their allocation into nosological categories. However, little has been achieved on ætiology —at least from a psychological perspective. There are putative biological explanations for some mental health conditions, but we need a robust psychological approach to align diagnosis with treatment (that is, *if* diagnosis is even needed). *If* treatment is to be aligned with diagnosis, but the diagnosis relies on an unsound descriptive-categorical system, then both practitioner and client (and researcher) start off from an inconsistent belief about what the problem is, which is bound

RFT: Relational Frame Theory.

to mislead the goals of treatment.

In this conference, we learned **XXXXXX**. We thank the participation of our invited speaker, Dr Miguel Rodríguez-Valverde, who kindly accepted to come over from Spain, to visit us here in Northern Ireland. We also thank our UU lecturer, Dr Eoin McElroy, who accepted to speak in this conference, and Dr Jordan Belisle, who agreed to speak remotely with a 6h difference! We also thank all poster presenters who kindly prepared abstracts and posters, and we thank the participation of all attendees.

Thank you, Prof Miguel Rodríguez-Valverde, Dr Eoin McElroy, and Dr Jordan Belisle!

Rodrigo Vianna de Almeida, 27th July 2023

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Bibliography

Augustson, E. M. & Dougher, M. J. (1997). The transfer of avoidance evoking functions through stimulus equivalence classes. *Journal of Behavior Therapy and Experimental Psychiatry*, 28(3), 181–191.

Belisle, J. & Dixon, M. (2020). Relational density theory: Nonlinearity of equivalence relating examined through higher-order volumetric-mass-density. *Perspectives on Behavior Science*, 43, 259—283.

DeGrandpre, R. J., Bickel, W. K., & Higgins, S. T. (1992). Emergent equivalence relations between interoceptive (drug) and exteroceptive (visual) stimuli. *Journal of the Experimental Analysis of Behavior*, 58(1), 9–18.

Dougher, M. J., Augustson, E., Markham, M. R., Greenway, D. E., & Wulfert, E. (1994). The transfer of respondent eliciting and extinction functions through stimulus equivalence classes. *Journal of the Experimental Analysis of Behavior*, 62(3), 331–351.

Dougher, M. J., Hamilton, D. A., Fink, B. C., & Harrington, J. (2007). Transformation of the discriminative and eliciting functions of generalized relational stimuli. *Journal of the Experimental Analysis of Behavior*, 88(2), 179–197.

Dunsmoor, J. E., White, A. J., & LaBar, K. S. (2011). Conceptual similarity promotes generalization of higher order fear learning. *Learning & Memory*, 18(3), 156–160.

Dymond, S. & Barnes, D. (1995). A transformation of self-discrimination response functions in accordance with the arbitrarily applicable relations of sameness, more than, and less than. *Journal of the Experimental Analysis of Behavior*, 64(2), 163–184.

Hayes, S. C., Barnes-Holmes, D., & Roche, B., Eds. (2001). *Relational Frame Theory: A Post-Skinnerian account of human language and cognition*. New York: Kluwer Academic/Plenum Publishers.

Horne, P. J. & Lowe, C. F. (1996). On the origins of naming and other symbolic behavior. *Journal of the Experimental Analysis of Behavior*, 65(1), 185–241.

Kendler, K. S., Zachar, P., & Craver, C. (2011). What kinds of things are psychiatric disorders? *Psychological Medicine*, 41(6), 1143–1150.

Lissek, S., Biggs, A. L., Rabin, S. J., Cornwell, B. R., Alvarez, R. P., Pine, D. S., & Grillon, C. (2008). Generalization of conditioned fear-potentiated startle in humans: Experimental validation and clinical relevance. *Behaviour Research and Therapy*, 46(5), 678–687.

Luciano, C., Becerra, I. G., & Valverde, M. R. (2007). The role of multiple-exemplar training and naming in establishing derived equivalence in an infant. *Journal of the Experimental Analysis of Behavior*, 87(3), 349–365.

Luciano, C., Molina, F., Gutiérrez-Martínez, O., Barnes-Holmes, D., Valdivia-Salas, S., Cabello, F., Barnes-Holmes, Y., Rodríguez-Valverde, M., & Wilson, K. G. (2010). The impact of acceptance-based versus avoidance-based protocols on discomfort. *Behavior Modification*, 34(2), 94–119.

Riess, B. F. (1940). Semantic conditioning involving the galvanic skin reflex. *Journal of Experimental Psychology*, 26(2), 238–240.

Rodríguez-Valverde, M., Luciano, C., & Barnes-Holmes, D. (2009). Transfer of aversive respondent elicitation in accordance with equivalence relations. *Journal of the Experimental Analysis of Behavior*, 92(1), 85–111.

Rodríguez-Valverde, M., Luciano, C., Barnes-Holmes, D., & Hernández-López, M. (2021). Transfer of conditioned fear and

avoidance: Concurrent measurement of arousal and operant responding. *Journal of the Experimental Analysis of Behavior*, 115(1), 204–223.

Stewart, I., Barnes-Holmes, D., Roche, B., & Smeets, P. M. (2002). A functional-analytic model of analogy: A relational frame analysis. *Journal of the Experimental Analysis of Behavior*, 78(3), 375–396.