



Adopting a Model of X-Y Axis to Understand the Client's Narrative and Presenting State

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Abstract

This paper introduces the innovative integration of the Cartesian Coordinate System (CCS) into psychotherapy to enhance client self-reflection and insight. The historical evolution of psychological theories and therapies is explored, highlighting the continuous quest for effective treatment. Inspired by René Descartes' mathematical system, the CCS is applied in psychotherapy as a tool in collaboration with the therapist-client bond, to graphically represent clients' presenting problems, facilitating structured breakdown and understanding through quadrants. The paper elaborates on the theoretical underpinnings, effectiveness of data visualisation, and the relevance of matrix systems in psychotherapy. The proposed CCS model is introduced, detailing its practical application in therapy through case illustrations. The model not only supports therapeutic progress but also offers potential for coping beyond therapy, enhancing personal awareness, cognitive restructuring, emotion regulation, and problem-solving. The model's inclusive design principles cater to diverse clients, including neurodivergent individuals. By promoting metacognition and empowerment, the CCS model contributes to a holistic approach to mental health and personal growth.

Keywords: Cartesian Coordinate System · Data visualisation · Matrix systems · Therapeutic tool.

Throughout antiquity, humankind has been in quest to find the treatment of all emotional problems. With the Greeks classifying mental illness for the first time as something beyond the evil spirits, to spiralling back to labelling mental disorders as calculative manoeuvre of demons in the middle ages, and to finally integrating moral treatment to

‘psycho-therapia’, as sharply termed by Dendy in 1853 (Haggerty, 2016), has absolutely revolutionised the field through brilliant works of Freud, Horney, Watson, Skinner, Beck, Ellis, Rogers, to name only a few of renowned contributors. Since then, clinical psychology and psychotherapy has emerged past the value-free techniques, outside of a social, economic, and political context, and allied with ever-changing forces of sociocultural interests (Hubbell, 2022; Marks, 2017).

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For all human history, the pursuit for the ultimate solution to breaking down and resolving problems has remained constant, throughout ever-evolving timelines and civilisations. Who would have thought that such a tactic of structural breakdown of a whole could be inspired by a fly on a wall?

Cartesian Coordinate System: From Mathematics to Psychotherapy

Based on a legend, René Descartes discovered the mathematical study of the Cartesian Coordinate System (CCS) lying sick in bed observing a fly positioned on a square tile ceiling. The coordinate system that bears René Descartes' name was originally published in 1637 and it is occasionally referred to as the Rectangular Coordinate System (Wright, 2021). Taking one corner of the room to serve as a reference point or origin, he noticed that the fly's position may be expressed as the number of tiles away from the origin, which divides the plane into four quadrants by the horizontal x-axis and vertical y-axis, numbered counterclockwise from the top right, both horizontally and vertically. Others also claim that the grid-method of paintings in the Renaissance may have also influenced Descartes (Williamson, 1986).

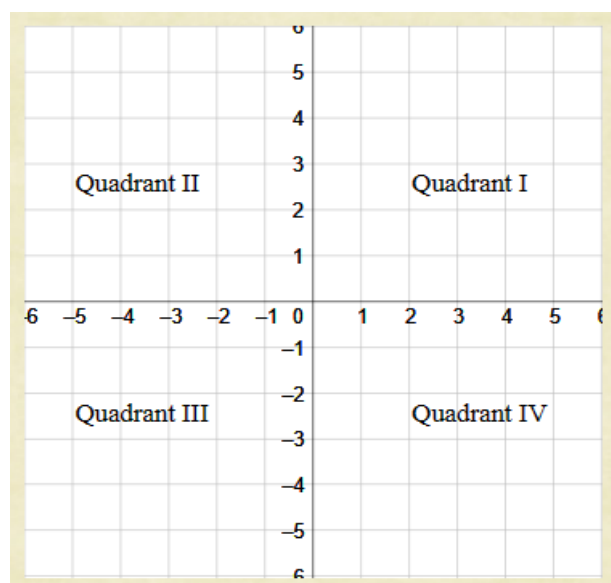


Figure 1 Four quadrants derived from a fly on a tile ceiling (Wright, 2021)



Figure 2 Four quadrants derived from a fly on a tile ceiling (Wright, 2021)

In psychology, CCS provides a methodology to understand the many various dimensions that can be measured, calculated, and manipulated algebraically, and also provide graphical representation. This escapes the limited comprehension of CCS mathematically and the 'data structure obtained is easy to represent (access), to normalize, and to visualize (Kusalik et al., 1999)' which aids in psychotherapy by a structural breakdown of the client's problem into visually-stimulated understanding with the help of quadrants.

Descartes' work on the coordinate system was closely linked to his broader philosophical project of developing a system of knowledge that was based on rationalism and mathematical reasoning. Today, its importance and versatility continue to make it a vital tool for understanding the structure of the physical world and for developing new technologies and scientific discoveries. It provides a framework for explaining postural rotations in medical sciences (Normand et al., 2007), determinism

theory (Duignan, 2012), engineering, astrophysics, and including psychology.

Structuralism school of thought, which is concerned with the study of mental experience and sought to investigate the structure of experience, and Descartes' substance monism, which is 'the view that the apparent plurality of substances is due to different states or appearances of a single substance' provide strong evidence for CCS' application in psychology by stressing upon viewing constructs as plural structures encompassing the objective reality (American Psychological Association, 2012; Urmson, 1991, p. 297). In psychotherapy, the adoption of CCS principles is best presented in the quadrants of the Johari window of the self wherein the client learns about the unknown and known aspects of the self (Luft & Ingham, 1955).

Effectiveness of Data Visualisation in Therapy

It is vital to look at the fundamental connection between visual perception and cognition. Humans are inherently visual creatures, and our brains are wired to process and interpret visual information more effectively than other forms of data. This understanding forms the basis for using data visualisation techniques in therapy to enhance communication, understanding, and engagement.

Graphical representation of clientele's problem has a long history in psychotherapy: in Cognitive Behavioural Therapy (thought record, belief hierarchy, activity scheduling); narrative therapy model (tree of life), Solution-Focused Brief Therapy (scaling questions & miracle question); Acceptance and Commitment Therapy (heraflex coordinates); trauma triangle (Karpman, 2020), to name a few. The effectiveness of graphical assistance can be explained due to the picture superiority

effect which explains that in comparison to words, visuals and images are more likely to be remembered, and hence prove to be helpful in therapy (Curran & Doyle, 2011). Basham (2002) also emphasised the importance of data visualisation in evaluating and presenting the outcomes of experimental group therapy education programs. By employing various graphical representations, he concluded that researchers can effectively communicate complex information, facilitate understanding among diverse audiences, and ultimately support evidence-based decision-making in the field.

By leveraging the power of data visualisation, therapists can augment their therapeutic interventions and help clients achieve better psychological outcomes. Ongoing work supports that by harnessing the innate human capacity for visual processing, data visualisations simplify complex information, promote self-reflection, empower designers and enhance engagement (Donska, n.d.). In line with the current paper, Boisvert & Ahmed (2018) has given a detailed account on how by representing concepts graphically, therapists can enhance understanding, facilitate communication, and promote insight and self-awareness in clients. Their practical guidance includes tips on creating visually appealing and meaningful diagrams, facilitating discussions around diagrams, and using them as a tool for assessment, goal setting, and tracking progress.

In the Counselling process, visualisation has involved analysing the counselee's objectives and options, strengthening their motivation and self-confidence, and bolstering their belief in a positive future (Kattelus, 2022). It is, thus, safe to interpret that integrating data visualisation into therapeutic practices can ultimately support clients in gaining deeper insights, making progress, and achieving positive

psychological outcomes, as metacognition, motivation, and self-regulation all hinge upon the premise of self-focused attention (Carver & Scheier, 1998; Silvia, 2014).

Relevance of Matrix System in Psychotherapy

The relevance of the matrix system holds validity with its vast application in the field of therapy with its urgency understood to cater to the client's multitude of contexts in an attempt to recognize the precedents of thoughts, feelings, and behaviours. The following are three contemporary models in mental health that are pertinent to the present paper.

Four-level Matrix-model of Clinical Psychology

Snyder and Elliott's model (2005) emerged as an educational guide for budding clinical psychologists with a focus on four-level of the client's context, i.e., individual, interpersonal, institutional, and societal/community, moving from micro to macro, indicating the nature of concentric relationship between these different levels of analyses. Beyond these, the matrix also represents the interactional nature of the source, i.e., personal or environmental, and valence, i.e., the clients strengths and weaknesses in a particular event. Thus, representing multiple dimensions of human experiences, presenting problems, and treatment approaches.

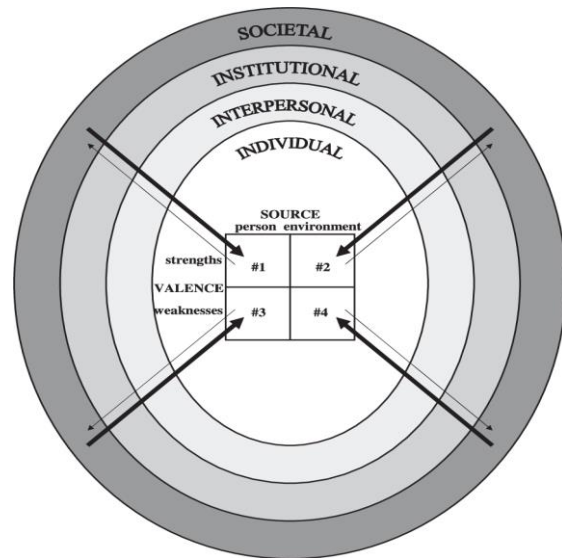


Figure 3 Four-level Matrix-model of Clinical Psychology (Snyder & Elliott, 2005)

Mental Illness-Health Matrix and the Mental State Space Matrix

This models introduces a metaconceptual frameworks for evaluating psychological states—comprising of the binaries of mental health and mental illness, located in the axis-Y and axis-X, respectively and encompassing it with a time-bound matrix of mental state space. Starting from quadrant I in the left towards quadrant IV in a clockwise direction, we see struggling, thriving, languishing, and faltering as dynamic aspects of the mental illness-health continuum. In this, Lomas and VanderWeele (2023) adds the Mental State Space Matrix as a temporal dimension, capturing the changes and fluctuations in mental states over time, allowing for the mapping of transitions, trajectories, and patterns, aiding targeted interventions and personalised treatment plans. Thus, equipping the professionals with visionary policy-making and diagnosis competence beyond the medical model of 'no illness' approach.

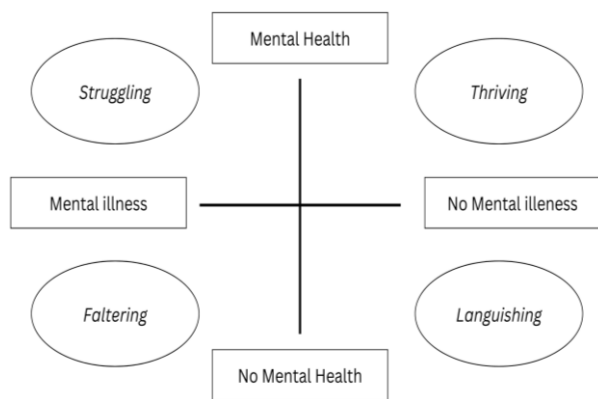


Figure 4 Mental Illness-Health Matrix (Lomas & VanderWeele, 2023)

Healing Matrix

Lastly, the healing matrix is presented as an integrative model that considers multiple dimensions, including physical, psychological, social, and spiritual aspects of human experience (Klein, & Schermer, 2000). This discusses various components of the healing matrix, including self-care, self-awareness, lifestyle factors, social support, and engagement in meaningful activities. It emphasises the interconnectedness of these dimensions and their impact on overall health and healing. This approach encourages individuals to take an active role in their own healing process. It promotes self-reflection, self-empowerment, and personal responsibility for one's health and well-being. This has been suggestive for bringing a "bird's eye view" to group therapy, especially in psychological trauma.

Prancing a step further, the matrix system has bestowed the field with chance of refinement and extension in varied applications through different therapeutic modality. We can see the influence of the matrix in the Matrix Model of

addiction treatment which places a strong emphasis on the therapeutic relationship between the clinician and the client. It fosters a collaborative and empowering approach, where clients are actively involved in their treatment planning and decision-making process (Mosel et al., 2023). The Acceptance and Commitment Therapy (ACT) Matrix consists of a grid with four quadrants. Each quadrant represents different aspects of human experience: "Self" (the individual's internal experiences), "Others" (relationships and social context), "Values" (what truly matters to the individual), and "Actions" (behavioural choices and goals). This has proven to be an excellent step-by-step guide for therapists to use the matrix in helping clients explore their thoughts, emotions, and behavioural patterns while connecting them to their core values of mindfulness, acceptance, and value-based action (Muller, 2022). Other therapies, such as, Internal Family Systems (Schwartz, 1998), Activity-Belief-Consequence model of cognitive behavioural therapy (Ellis, 2000), Dialectical Behavior Therapy (Linehan, 1993), Rational Emotive Behavior Therapy, Gestalt Therapy, etc., share similarities with the matrix systems and indicates the versatility of its application.

Creating a Guided Objective Reality of the Client

Inspired by Cartesian-dualist ontology, a realist and objectivist wedded correspondence theory of truth, Foucault (1973) located the beginning of the modern conception of 'madness' as driven by irrational experience; which may be an experience inaccurately corresponding to the 'objective' world— and disorder as perpetuation of that 'occasion of error'; while Freud's psychology laid emphasis on intrapsychic phenomena ignoring other sorts of mentations. This bestowed a certain omnipotence. However, this has been accused of being 'pan-

experiential’, in empiricist-materialist terms and idealist-learning theories, nurturing ‘the hard problem’ of consciousness’ (Chalmers, 1995). Meanwhile, Dresser (2019) put forth a convincing stance towards ‘rethinking about mental disorder on a metaphysical level, and not just within the confines of the status quo (objective reality)’.

Owing to the above understanding of the Cartesian-Matrix system and its implications on psychotherapy, the following proposed model is designed to cater to the client’s subjective experience in collaboration with their objective reality. It aims to provide the effectiveness of using Cartesian Plane as a therapeutic tool to graphically represent the client’s objective interpretation of their presenting problem and chunking the information into four accessible quadrants, using a top-down processing approach that utilises the frontal or cognitive resources of the brain (Gregory, 1970).

Tips to Building a Visual Data Model

Obtaining insights and trends from the data that needs to be visualised can be extremely time-consuming and labour-intensive. Data visualisations work effectively because they blend perception and cognition in a way that best utilises the brain's capabilities. The visual cortex at the back of the brain is incredibly quick and effective in processing what we see (visual perception).

Experts at Treehouse Technology Group (2021) have laid down five characteristics of data visualisation that people find most compelling and impactful, which can change their perspective and provide clarity regarding the next course of action:

- Truthful – It should be based on thorough and objective research.

- Functional – It should be accurate and allow your users to act upon your information.
- Beautiful – It needs to be well-designed and draw the user’s attention through an aesthetically pleasing display of information.
- Insightful – It needs to provide information like trends, insights, and inferences that would be difficult to see otherwise.
- Enlightening – It needs to highlight your evidence, tell a story and enlighten users with your information in a way that is easy to understand.

The following model thrives to capture these aspects in order to cater to a just representation of the client’s context in therapy.

The Model: Cartesian Plane as a Therapeutic Tool

The rationale behind the proposal of this model is an attempt to establish a graphical technique for client’s visualisation of their presenting problem by breaking it down into meaningful categorizations. This will incur collaborative efforts between therapist and client to curate a X-Y bifurcation from the point of reference as the client’s here-and-now experience (0,0), with X representing the general timeline (left as past and right as future) and Y-axis representing the bigger or smaller context of the presenting problem (refer to Figure 4). This aims to help the client realise a more “holistic context” to their problem, which Gestalten's perspective will refer to as achieving a figure-ground reality. The cartesian quadrants will also allow the therapeutic alliance to get visual aid and narrower clarity on the issues that need immediate focus and work at smaller cognitive unit capacities than the largest presenting problem state, giving greater empowerment, insight and self-reflection to the client.

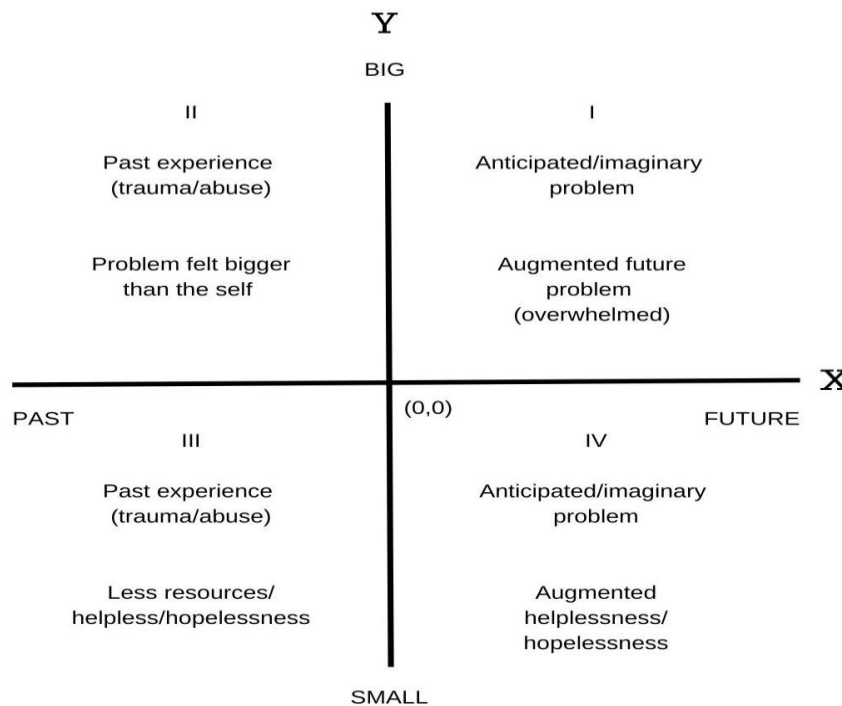


Figure 5 Cartesian Plane

Case I

For a better understanding, let us take the case of client X:

X (she/her), a 22 year-old cis woman, undergoing transition from resignation from her job and fear of rejections. X also has a history of self-reported anxiety since childhood which is known to her family and friends who act as supportive agents when X’s anxiety goes beyond her control. It was contemplated that building a space to share and introspective would be helpful.

With the help of CCS model, X’s presenting problem could be visually represented with facilitation of the therapist, where point of reference is her current state (22 years, unemployed). To structure the client’s problem chunk, the therapist tackles along with the client with the following questions—where is the client’s problem focused temporally (past or

future)? What are the resources that the client possesses currently, both personal and social?

From this, the therapist may plot anticipated future problems in Quadrant I, i.e., fear of rejection or starting afresh in career, where the client feels overwhelmed by this big opportunity (refer to Figure 4). As the therapist and X review the plotted events, they look for patterns or triggers that may be contributing to her current challenges. This allows X to gain a deeper understanding of the connections between her past experiences, anxiety, and fear of rejection. The therapist helps X develop a safe space for self-reflection and exploration. This may involve journaling, mindfulness exercises, or other techniques to encourage introspection and self-awareness. The therapist works with X to identify how her family and friends can play a role in supporting her during periods of heightened anxiety. They explore

strategies for seeking assistance and communication with her supportive network.

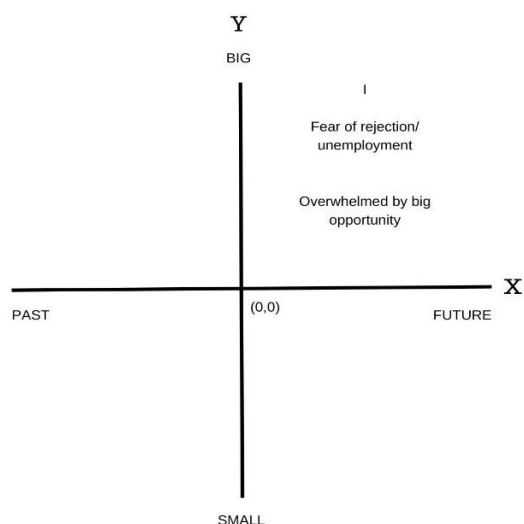


Figure 6 Case of X

Now, the client has a well-plotted image of her 'problem chunk' and can visually navigate her problem areas with help of her reference point and focus on the area she would like to work towards in therapy. Here, the therapist then guides the client with directive questions, so as to help the client reach their optimum awareness.

Case II

Z (he/him), a 45-year-old individual, seeks therapy to address unresolved emotional issues from his past. He experienced a traumatic event in his childhood that continues to impact his daily life and relationships. Z wants to explore and process his past experiences to achieve healing and growth.

In this case, the therapist suggests using the Cartesian Plane as a therapeutic tool to help Z visualise and categorise his past experiences. Together, the therapist and Z

identify the present moment as the point (0,0) on the Cartesian Plane, representing Z's current experience and emotional state. Based on significant events from his past, the therapist may plot Z's case in Quadrant III, i.e., traumatic childhood where the client felt smaller and helpless with inadequate resources. This helps create a timeline of Z's life experiences.

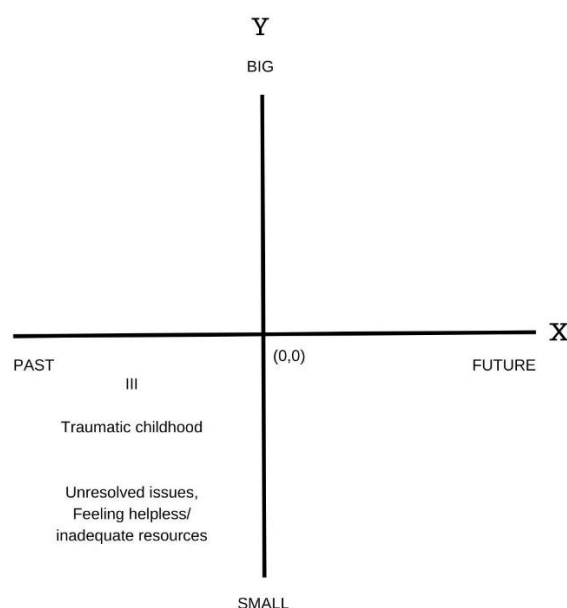


Figure 7 Case of Z

By placing events on the Y-axis, Z assigns a level of emotional impact or significance to each experience. This process allows him to acknowledge and explore the varying intensities of his emotions associated with different events. As the therapist and Z review the plotted events, they may begin to identify patterns, recurring themes, or triggers that are related to Z's past trauma. This assists in gaining insight into the connections between events and their impact on his current well-being. Using the Cartesian Plane, Z and the therapist can work through each event, processing emotions, and developing coping strategies. The therapist

provides support, validation, and guidance throughout this process, helping Z navigate his healing journey.

By utilising the Cartesian Plane as a therapeutic tool, Z gains a visual representation of his past experiences, allowing for a structured exploration and processing of his emotions. This approach helps him identify patterns, make connections between events and emotions, and work towards healing and growth. Ultimately, Z may experience a reduction in emotional distress, improved coping mechanisms, and a greater sense of resolution regarding his past trauma.

This ameliorates the burden of the concerning problem and gives the client flexibility to add or remove aspects in each quadrant throughout their therapy sessions. It is also valid to reason that this technique could also be used as both a therapy visual tool as well as a coping technique for the client which could be performed for immediate problems. It is important to note here that the motivation behind providing this Cartesian Plane technique is to psychoeducate and also engage in a beneficial share of resources between the client and the therapist. The paper, namely, *Data Visualization for Psychotherapy Progress Tracking* explores the use of data visualisation techniques to track and monitor progress in psychotherapy. It discusses how visual representations of client data, such as emotions, symptoms, and therapeutic outcomes, can aid therapists in understanding and analysing treatment progress more effectively. By visualising data trends and patterns, therapists can gain valuable insights, facilitate better communication with clients, and make informed decisions about treatment adjustments.

Facilitating Metacognition in Offline Mode

The proposed CCS model finds inspiration from human-computer interactive modes, such as photo-journaling and Remote Measurement Technologies (RMT), that have become essential luxuries in current times. Literature in the field has suggested that the combination of momentary photo-based recording and retrospective data visualisation, reported increased self-awareness as they reviewed and reflected on their photos and emotional labels. This provided an accessible overview of their emotional patterns, leading to a deeper understanding of their thoughts and behaviours (Karaturhan et al., 2022). Findings in RMT underscore the potential of data visualisation in enhancing metacognition and self-management among individuals with chronic neurological and mental health conditions. By providing accessible and visually engaging representations of data, it facilitates self-awareness and empower users to take an active role in managing their health effectively (Polhemus et al., 2022). However, CCS goes a step beyond the internet-mediated techniques and embraces the trust in client's memory, psyche and overall context to uniquely appropriate their experiences, all too in an offline mode, making it intimately accessible as a tool in therapy and individual coping similar to journaling, meanwhile acknowledging the potential data visualisation has provided exceptional assistance in psychotherapy.

Relevant research has fostered scope of visual data representation as a source towards tangible support towards metacognitive processes, facilitating informed decision-making and fostering a sense of agency in children and adolescents (Eslambolchilar et al., 2023). Eberhard (2023) maps the extent to which visual representations aid individuals in understanding complex information,

identifying patterns, and evaluating alternatives. This, in turn, leads to more informed and confident decision-making through self-monitoring, self-reflection, and self-regulation. Feasibility of metacognitive therapy, too, instils faith in visual forms of client's data representations of cognitive patterns, eventually providing valuable insights, enabling individuals to identify maladaptive thinking patterns and develop more adaptive coping strategies (Dominicis et al., 2021). Given that CCS mimics the aforementioned aspects of data visualisation, the model holds the essence of probable success in different forms of therapeutic interventions and further may even be promoted as a coping tool.

CCS as a Tool for Coping Beyond Therapy

Although the CCS model is constricted to limited research, the model casts embryonic prospects to be used by the client as a tool for self-coping beyond therapy. This claim underlines behind the similarities between self-help and visualisation techniques, and the CCS model:

- **Personal Awareness:** The CCS model, with its graphical representation of the client's presenting problem, can promote personal awareness and self-reflection even outside therapy. By visualising their experiences and organising them into quadrants, individuals can better understand the various aspects of their challenges and emotions.
- **Cognitive Restructuring:** The model's focus on breaking down problems into quadrants may aid individuals in identifying cognitive patterns, cognitive distortions, or unhelpful thought processes. This could facilitate cognitive restructuring, which involves challenging and replacing negative thought

patterns with more balanced and positive ones.

- **Goal Setting and Monitoring:** As a coping tool, individuals can use the CCS model to set personal goals and track progress over time. By plotting new events or changes on the Cartesian Plane, they can visualise their achievements and areas for growth, which can enhance motivation and resilience.
- **Emotion Regulation:** The CCS model's visual representation of emotions and experiences may help individuals in regulating their emotions and identifying triggers that affect their emotional well-being. This can support the development of healthy coping mechanisms and emotional regulation strategies.
- **Problem-Solving:** The CCS model can encourage individuals to analyse their challenges from different angles and identify potential solutions. By breaking down problems into quadrants, they may gain insights into the complexity of the situation and explore diverse perspectives.
- **Stress Reduction:** Engaging with the CCS model as a coping tool may provide a structured and systematic approach to managing stress and overwhelming situations. The act of visually organising thoughts and experiences can create a sense of order and control.

A Step Past Neurotypicality

Even though the current model is modelled for the clients who are not in the clinical spectrum, its accessibility does not remain finite to the neurotypical clients. Inclusive design principles involve clear and consistent visual communication and design patterns, avoiding overwhelming stimuli, and offering

customizable features or personalisation (Careri, 2022; Wu et al., 2021). CCS model enhances cognitive load management by ensuring that information is presented in a structured and easily digestible manner and simplifying complex concepts and avoiding ambiguous language can improve comprehension for neurodivergent audiences. As the model can be made tangible in an offline mode, it naturally avoids sensory processing sensitivities, such as loud audio and bright lightning, unlike computer-mediated data visualisation techniques. Using a graphical structure, it also attempts to incorporate visual hierarchy that has been suggested to be preferred for specifically neurodivergent clients. Moreover, offers intuitive and clear feedback opportunities to reduce confusion and support the client-therapist engagement.

Conclusion

Overall, the infusion of the cartesian model in therapy and beyond signifies a paradigm shift towards a more holistic and visually engaging approach to mental health. Drawing inspiration from René Descartes' mathematical system, the CCS model provides a structured and visually-stimulated representation of the client's presenting problem, allowing for a breakdown of complex issues into accessible quadrants. The model extends beyond therapy and can serve as a coping tool for clients in their daily lives and admires possibilities that are not limited to neurotypical clients; it holds assurance as an inclusive tool. By encouraging metacognition and personal empowerment, this model stands to revolutionise the therapeutic landscape and empower clients in their journey towards emotional well-being and personal growth.

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Declarations

Conflicts of interest: The author has no conflicts of interest.

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