What Moves in CONNECTEDkind?

-A Study via EEG Spectral Features-

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1. Introduction

CONNECTEDkind (Ck) is an educational practice that begins with play. In this paper, “play” does not mean leisure or diversion. In Ck, “play” is designed as an instructional pathway that brings imagination to the real world and enables reflective and practical reconnection with nearby nature, relationships with peers previously taken for granted, and hope for the future held by each participant. Ck was developed in response to social disconnection associated with the COVID-19 pandemic and a persistent sense of stalled momentum afterward. Imagination can become fragile, and an actionable methodology is urgently needed under such conditions. Through repeated implementation, Ck has been refined into a learnable method with reproducible procedures.

In Ck, participants use photographs that include natural objects and their shadows as motifs. Participants create drawings inspired by the motifs, digitize the artworks, and share them as digital outputs. A defining feature of Ck is that diverse artworks emerge from the same motif. Research on “Mitate” in art education has often converged on analyzing externally expressed representations produced by participants and clarifying their functional roles. While this diversity should be respected in educational practice, it is also important to examine how it emerges during the brief production period. This includes where attention is allocated and how the balance between tension and relaxation shifts during the transition into production. In this paper, this process is referred to as the entry point into production, and it is treated as a transition of internal state. Electroencephalography (EEG) was measured during Ck practice to observe this transition.

This paper adopts the following stance. If the essence of the natural sciences lies in reproducibility that does not depend on the person, the essence of art lies in accompanying individual experience beyond objective judgment. Accordingly, EEG is not used to judge the quality (or merit) of expression. EEG is positioned as a supporting perspective that helps keep differences from becoming matters of evaluation. The aim is to articulate, in terms usable for educational practice, what can be inferred about transitions of internal state from spectral features observed during Ck.

2. EEG Analysis During Ck Practice

Four university students in education-related programs participated, and none were art majors. EEG was recorded using the headband-type device Muse (InteraXon Inc.). Participants who were not art majors were selected to minimize the influence of cognition associated with prior expertise and technique. This selection supports observation of internal-state transitions associated with Ck as directly as possible. Muse enables relatively simple measurement in postures close to practical educational settings. However, it is limited relative to medical-grade systems in channel count and wearing conditions. Therefore, the present approach does not aim at individual EEG diagnosis. It aims to characterize transitions of internal state in the Ck setting as changes in spectral profile. In this paper, internal state means a cognitive state that includes the direction of attention and the level of arousal, expressed as tension and relaxation.

Relative changes in spectral profiles across frequency bands such as alpha, theta, and beta were interpreted as approximate indicators of internal state. The protocol comprised two steps: (1) a quiet meditation state was used as a baseline to establish the EEG spectrum; (2) Ck practice using paper media was conducted while tracking time-resolved changes in spectral power. The analysis focused on relative band dominance and its transitions. Emphasis was not placed on momentary waveforms. Instead, attention was directed to how internal activity emerges during the shift into Ck,

and to how the balance between tension and relaxation and the level of concentration change over time.

Figures 1 and 2 present, for two illustrative participants, (1) EEG spectra during the meditation baseline, (2) EEG spectra during Ck practice, and (3) the completed artworks. Student C showed an alpha-dominant tendency, and Student D showed a beta-dominant tendency. For Student C (Fig. 1), relative alpha band dominance tended to be maintained during production. The completed artwork suggests that the participant may have accepted the act of practicing Ck itself and may have linked the production process to a positive experience (enjoyment). For Student D (Fig. 2), beta band dominance tended to remain highest, and it was accompanied by gamma-band activation. This pattern suggests sustained concentration during production. The completed artwork reproduces salient features of the motif, including size, form, and texture, in a form that is readily interpretable by others. This is consistent with a realistic, task-focused form of engagement.

Across these cases, the association between stylistic tendencies and spectral profiles is, to some extent, intuitively interpretable. This interpretability may reflect a habitual tendency to interpret relations between expression and internal state through the framework of temperament, shaped by prior encounters with individual differences. Accordingly, the present findings suggest that temperament may contribute to the time course of spectral change from the baseline meditation state into Ck practice.

3. What Moves in CONNECTEDkind?

These observations indicate that person-specific patterns were observed in the transition of EEG spectra during Ck practice. What was observed in this study was the process of how internal state associated with Ck practice transitions from onset through the time course of production. In this chapter, using the differences in relative band dominance and their transitions observed in Student C

and Student D as clues, differences arising in the Ck setting are examined through the lens of temperament.

For Student C (Fig. 1), relative alpha band dominance tended to be maintained during production, and the resulting artwork was consistent with a positive engagement with the production process. In contrast, Student D in Fig. 2 showed sustained beta band dominance, with accompanying gamma band activation, suggesting strong concentration on the creative act. The key point here is not the superiority of one pattern over another, but the variability in how internal state shifts from the meditation state to Ck. A distinctive feature of Ck is that materials that appear physically objective, namely natural objects and shadows, can acquire different meanings within the individual. The value of Ck lies in diversity of expression, rather than conformity to a single norm. It lies in enabling a safe experience of the fact that even with the same motif, the quality of experience can differ with differences in the way of relating to the world. In educational settings, there are situations in which differences in child expression are likely to be absorbed into judgment and evaluation as superiority or inferiority in skill or imagination. Ck aims to step back from such ranking, bring imagination into the real world, and restore connections with nearby nature, with peers previously taken for granted, and with hope for the future held by each participant. However, ranking cannot be avoided simply by moderating evaluative language. As long as artworks are received through fixed standards, differences will reappear as judgments in another form. Therefore, we need an interpretive framework that treats differences as ways of relating to the world, not as biases to be corrected.

To frame this contrast, it is helpful to refer to Rudolf Steiner's typology of the four temperaments: choleric, sanguine, melancholic, and phlegmatic. It should be recognized that temperament originates within a person, yet it also appears in outward behavior. Of course, there is no intention to map frequency bands and temperaments one to one, and temperament is referenced here as an interpretive frame for holding individual differences in how participants engage with Ck.

On that basis, in order to make the interpretation more concrete, Student C in Fig. 1 is provisionally placed as having a phlegmatic tendency, and Student D in Fig. 2 is provisionally

placed as having a melancholic tendency. In Student C, a tendency was confirmed in which the relative dominance of the alpha band was maintained during Ck practice, and it suggests that the production process is linked to a positive experience (enjoyment). This can be understood as a way of relating in which the participant faces the motif within a certain calmness and continues production. In contrast, Student D showed a tendency in which the beta band maintains top ranking in the spectrum, and activation in the gamma band also accompanied it, suggesting concentration on the creative act. This can be understood as a way of relating in which attention is maintained while preserving logical coherence in handling the motif, and the participant confronts the task. After the transition from the meditation state to Ck, time-resolved spectral power often shows shifts in relative band dominance. However, it can be regarded that differences in entry point continue to remain as a pattern of subsequent transitions of internal state. In other words, Student C with a phlegmatic tendency shows a strong tendency to develop around an axis of concentration and relaxation, whereas Student D with a melancholic tendency shows a strong tendency to confront the task while maintaining logical thinking and attention. Both participants face the task seriously. However, it is reasonable to regard differences in how engagement is established—namely, how participants take the entry point into production.

Therefore, what teachers need is not instruction that forces learners into a uniform internal state, but design that can accommodate variability in internal state. First, realism, signification, and abstraction should be recognized as equally acceptable forms of expression for each learner. Accordingly, shared content should foreground how the motif was construed over completeness. EEG functions as an objective indicator to support interpretation, not as a substitute for artistic value judgments. In educational settings, it offers a complementary perspective that helps sustain respect for individual differences in expression.

In conclusion, differences in EEG in Ck may include factors that derive from individual temperament. Therefore, it is important to ensure that participants can engage in Ck while preserving individual temperament. “What moves in Ck?” is not the superiority or inferiority of the artwork. It is a process that enables each participant to regain an entry point for reconnecting with the world. Ck

does not require engagement to take a single form; its educational potential lies in sustaining plurality.

References

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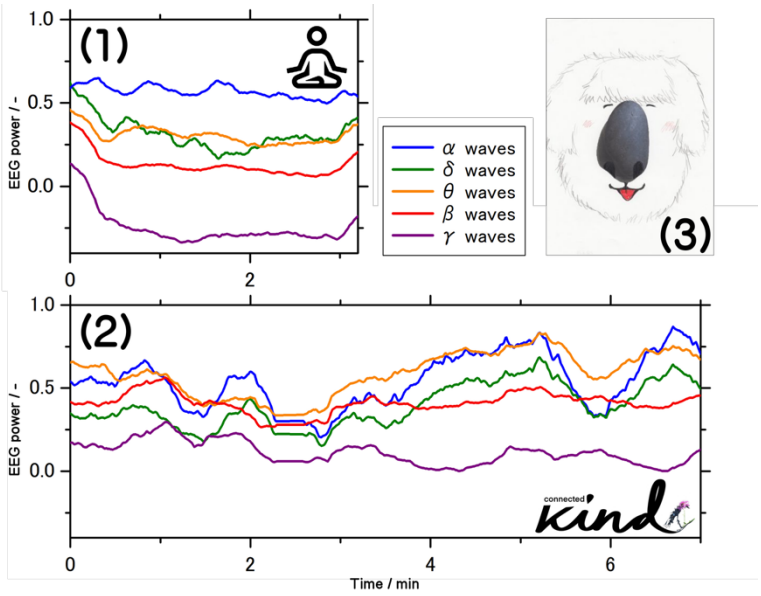

Figure 1. Student C: (1) EEG spectrum during the meditation state (baseline), (2) EEG spectrum during Ck practice, (3) completed artwork.

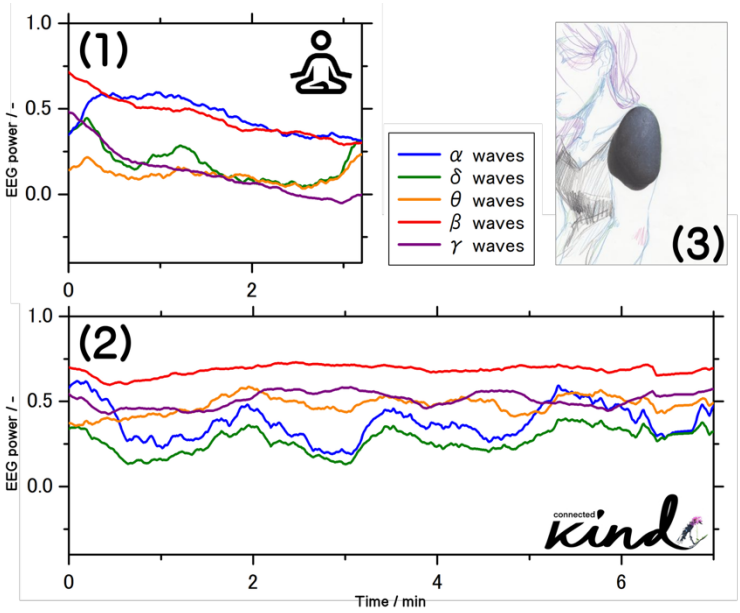

Figure 2. Student D: (1) EEG spectrum during the meditation state (baseline), (2) EEG spectrum during Ck practice, (3) completed artwork.