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Facial Emotion Expressionduring Trajectory Equifinality Approach Interview in Participant with Depression Symptoms

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ABSTRACT :*The aim of this study is to explore Facial Emotion during a TEA (Trajectory Equifinality Approach) interview in participants with depressive symptoms. Implicit nonverbal behavioris needed to study in clinical setting especially participant who have depression symptoms. We focused to explore the dynamics of emotions and facial expression emotional representation during a participant's life trajectory at the past, present and the future event.Simultaneously, mixed methods were used by combining qualitative and quantitative methods.For qualitative methods,we administered the TEA by interviewing the bifurcation point (BFP) during his past and the Equifinality point (EFP) or the present event and imagination of their future. Thematic analysis was performed for word expressions for each of BFP,EFP and the future. Forthe quantitative research, we recorded the facial expression participant during the TEA Interview. Our findings indicated Action Units of AU4,AU5, AU7 and AU15 as markers of sadness, fear and anger involved significantly during the interview. These markers supported the qualitative research result due to the word expression of the past, the present and future.*

KEYWORDS –*Facial Action Unit, Emotion, Trajectory Equifinality Approach, Depression*

I. INTRODUCTION

Research in facial emotion processing in major depressive disorder (MDD) subjects studiedbias emotion recognition especially slow response and bias emotional detection (Wang et al, 2021). In line with the development in face recognition technology, research exploredthe facial expression in depressive subjects have developed recently(Gavrilescu and Vizireanu, 2019; Cohn etal,2009).

There are two reasons we conduct this research.Firstly, facial expression analysis is very important data in the interview processespecially for non-language related data in qualitative research (Ismail,2017).Facial emotion expression can be measured by observing the movement of facial muscles due to the improvement in face recognition technology. Each emotion can be detected by combination muscular movement that expresses human emotion. Each of muscle location namely Action Unit (AU) can be detected by video processing analytic system. Each emotion has its own AU marker. Seven emotions can be detected by the Facial Action Unit are happiness (AU6,AU12), sadness AU1,AU4,AU15), surprise (AU1,AU2,AU5B,AU26), fear (AU1, AU2, AU4, AU5, AU7, AU20, AU26), anger (AU4, AU5, AU7, AU23), disgust (AU9,AU15,AU16), and contempt (AU 12, AU 14). The ability of Facial Action Unit to detect depression by using facial action unit had been proven by previous studies (Girard etal, 2016). AU12 and AU 15 are the prominent AUs in determining depressive symptoms. AU 15 was action unit associated with sadness emotion.

Secondly, facial action unit had been studied in major depression patient (Hayhurst,1997). However, rarely found studies measure the dynamic of facial expression in participants with depression symptoms. Previous study suggested research to develop new testing paradigm in facial emotion in depressive subject

(Stuhrmann, 2011). Therefore,we proposed the dynamic of facial emotion expression duringlife trajectory interview. The closest concept for life trajectory interview is trajectoryequifinality approach (TEA). TEA is a method describing a life trajectory within irreversible time.Thebasic notion of TEA is bifurcation points, equifinality points and trajectory. TEA is open theory with three layers model of genesis (TLMG). This model combinedmicrogenesis, mesogenesis and ontogenesis into a framework in order to understand transactional and self-dialogical process(Sato et all, 2016; Sato et all 2009).Trajectory equifinality approach interviews focused onbifurcation points (BFP), Equifinality point (EFP) and next path of future. BFP is a point where/when activities are guided to move in one direction. Equifinality point is a point that multiple trajectories to reach at the present. Previous qualitative research on depression supported the TLMG that depression patient had self-dialog and related to social support of mesogenesis environment (Weitkamp, 2016).

Accordingly, to understand facial emotions expression in depression subjects, we combined TEA interview and the latest of development in face recognition especially in facial emotion expression.

II. METHODS

Mixed methods design

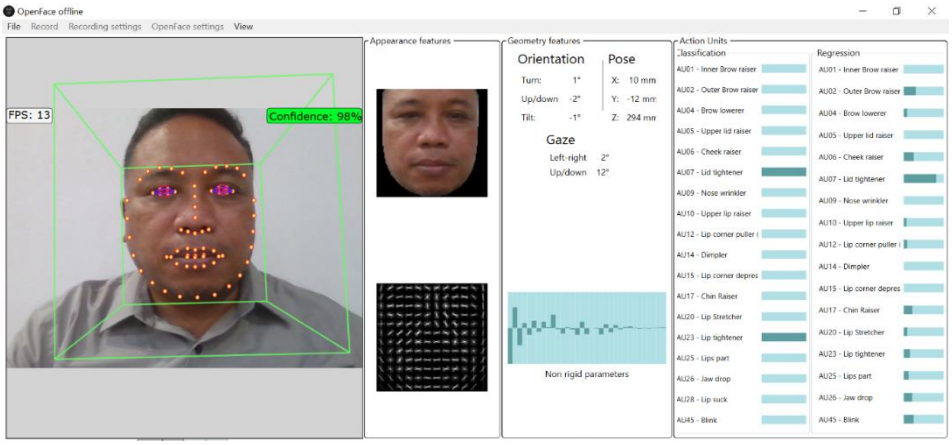
We applied simultaneous mixed methods that both of quantitative and qualitative approach hold together in the same stage(Schoonenboom& Johnson, 2017). Qualitative methods we employed the TEA interview to explore the participant experience during BFP at the past, the present and the future. We explored the BFP of participants and we asked them to draw the trajectory of life from their perspective. Further we asked to describe in adjective words that represent their experience in the past, present and the future. Quantitative methods we use visual analysis of facial action unit to detect facial muscular movement during an interview. Statistical analysis to calculate the implicit facial action unit, screening the depression symptoms and words that were frequently used to express their experience in the past, present and future.

Participants

We recruited 18 university students aged 18-22 who fulfilled the inclusion criteria. Participants shouldhave at least 5 symptoms of depression according to Diagnostic Statistical Manual of mental disorder (DSM 5) (see table 1). Informed consent was fulfilled before theinterview.Participant could leave the session if they felt uncomfortable during the interview. For the participants who have suicidal ideation symptoms at the end of interview had been suggested to visit professional clinical psychologist or psychiatristin order to have further mental health examination.

Measurement

Measurement of depression symptoms was administrated screening questionnaire for mental disorder by using DSM 5 depression criteria. Facial action unit measurement using video records focused on the facial landmark during the interview (picture 1).The measurement of facial action unit of facial muscular unit was calculated with freeware software of OpenFace(Baltrušaitis, 2016). We calculated the muscular movement or AU (Action Unit) as listed at table 3.



Picture 1. Facial Action unit measurement using facial landmark in OpenFace Program.

TEA Interview Procedures

Firstly, before the procedure began, we explained the Trajectory Equifinality Approach interview to the participants. Participants were given informed consent before the interview. Secondly,we focused on the bifurcation point at the past, present and in the future by interviewing participants pertaining to their experiences. When the interview was in progress, a video camera was turned on to record participants' facial activities. Thirdly, we asked participants to draw each of bifurcation points based on their experiences and expectations at the paper. Fourthly, we asked them to describe with adjective words about their expression of the past, present and future.

Data Analysis

Thematic qualitative data analysis used to study participant trajectory drawing and words expression. Video records of implicit facial action unit were analyzed by the score of facial muscular movement or AU scores. For the statistical differences among AU unit among the BFP at the past, the present and the future, we employed the nonparametric statistics of Friedman. The JASPstatistical program wasapplied (van Doorn et al, 2021)

III. RESULTS AND DISCUSSION

All participants had specific symptoms of depression (Table 1). We found thesymptomatic depression result were inline with the word expression of participants about their past, present and future experience (Table 2). However, we found a more positive emotion about participant's imagination about their future. Statistically, we found significant statistical differences of dynamic muscular activity at AU 4, AU 5, AU 7, and AU 15 during the TEA interview (table 3 and 4). These AUs indicatedfacial muscular markers of sadness, fear, and anger.

Table 1. Specifics Depression Symptoms of participants

Depression Symptoms	F	%
Decreased interest or pleasure in most activities, most of each day	18.00	100.00
Significant weight change (5%) or change in appetite	15.00	83.33
Change in sleep (Insomnia or hypersomnia)	17.00	94.44
Fatigue or loss of energy	14.00	77.78
Guilt/worthlessness	12.00	66.67
Diminished ability to think or concentrate, or more indecisiveness	13.00	72.22
Thoughts of death or suicide, or has suicide plan	9.00	50.00
Change in activity: Psychomotor agitation or retardation	13.00	72.22
Depressed mood or irritable	9.00	50.00

There two main symptoms depression of participant including anhedonia, insomnia or hypersomnia, and weight change or change in appetite. The psychological developmental age of participant at emerging adulthood stage influenced the symptoms of depression(van Doorn et al, 2007).

Tabel.2 Word of expression for BFP, EFP and the future imagination

Bifurcation points at the past	The present as equifinality point	The future
Painful, traumatic, mixed emotions,trash, dark, happy, grace, shame, boredom.	Happy, enthusiastic, challenge, dark, sad, lonely confused, disappointed, rebellion, decline, grace, empty, less kind, happy, guilty, scared, lonely, upset, depressed, stress, fatigue, feeling unappreciated, uninspired, sad, worried, confused, vengeful	Awesome, amazing. bright,unpredictable, uncertainty, fear, unpreparedness, difficulty, grace happy, successful,bright, proud, to be appreciated, love, happiness

Table 3. Friedman repeated measure among the past (BFP), the present (EFP) and the future

Action Unit		Facial Muscular System	χ^2	df	P
AU1	Inner Brow Raiser	Frontalis, pars medialis	3.44	2	0.179
AU2	Outer Brow Raiser	Frontalis, pars lateralis	1.33	2	0.513
AU4	Brow Lower	Depressor Glabellae, Depressor Supercilii Corrugator	7.44	2	0.024*
AU5	Upper Lid Raiser	Levator palpebrae superioris	12.1	2	0.002*
AU6	Cheek Raiser	Orbicularis oculi, pars orbitalis	0.444	2	0.801
AU7	Lid Tightener	Orbicularis oculi, pars palpebralis	6.33	2	0.042*
AU9	Nose Wrinkler	Levator labii superioris alaquae nasi	4.78	2	0.092
AU10	Upper Lip Raiser	Levator Labii Superioris, Caput infraorbitalis	1	2	0.607
AU12	Lip Corner Puller	Zygomatic Major	2.11	2	0.348
AU14	Dimpler	Buccinator	3.44	2	0.179
AU15	Lip Corner Depressor	Depressor angulioris/Triangularis	8.78	2	0.012*
AU17	Chin Raiser	Mentalis	0.778	2	0.678
AU20	Lip stretcher	Risorius	3.44	2	0.179
AU23	Lip Tightener	Orbicularis oris	0.444	2	0.801
AU25	Lips part	Depressor Labii, Relaxation of Mentalis, Orbicularis Oris	1.78	2	0.411
AU26	Jaw Drop	Masetter; Temporal and Internal Pterygoid relaxed	0.444	2	0.801
AU45	Blink	Relaxation of Levator Palpebrae&Contraction of Orbicularis Oculi, Pars Palpebralis	4.78	2	0.092

Note * = $p < 0.05$

The TEA interview emphasized trajectory alternatives pathways in their life. The dynamic of emotion during the TEA interview clearly resulted in distinguished emotion and facial emotional responses explicitly and implicitly. Explicitly, from the theme of word expression shown at table 3. The choice of words is closely related to the depression symptoms at table 1.Participants stated their life problems at BFP were bullying experience, family conflict and romantic relations. Life event stress at the past triggered the development of

depression (Yang et al, 2015). The traumatic past life developed one of important symptom in depression suicidal ideation in our participants. Our finding theme during interview found suicide as alternative path that the participants confessed. Traumatic life events at BFP lead the participants to develop suicidal ideation (Jin et al, 2021).

Table 3 showed our findings clearly found the importance of implicit nonverbal expressions of AU4, AU5, AU7, AU15 that represented the dynamic of participant's implicitfacial emotions expression at BFP and EFP and future. These AUs involved facial emotional expression of sadness (AU1,**AU4**, **AU15**), fear (AU1, AU2,**AU4**, **AU5**, AU20 and AU 26) and anger (**AU4**, **AU5**, **AU7** and AU 23). TEA interviews model stimulated these implicit facial emotions. Our finding supported previous research that AU 12 and AU15 as the marker for depression.

Table 4.Pair wise (Durbin Conover) comparison among the past (BFP), the present (EFP) and the future

Pair wise			**Statistic**	**P**
Past AU4	-	Present AU4	2	0.053
Past AU4	-	Future AU4	2.91	0.006**
Present AU4	-	Future AU4	0.909	0.37
Past AU5	-	Present AU5	0.398	0.693
Past AU5	-	Future AU5	3.38	0.002**
Present AU5	-	Future AU5	3.778	< .001**
Past AU 7	-	Present AU7	1.07	0.292
Past AU 7	-	Future AU7	2.68	0.011*
Present AU7	-	Future AU7	1.61	0.118
Past AU15	-	Present AU15	0.745	0.461
Past AU15	-	Future AU15	2.421	0.021*
Present AU15	-	Future AU15	3.166	0.003**

Note * p<0.05 and ** p<0.01

Sadness emotion in depression can be attributed to decreased activity of norepinephrine, serotonin and dopamine. These monoamines are key neurotransmitters that affect mood. However, the abnormality in hypothalamic-pituitary-adrenal (HPA) axis can be a considerable factor due to its ability to manage stress(Durà-Vilà, 2017). The fear emotion in depression is caused by anxiety. Depression itself cannot generate fear emotion in an individual. One study suggested that fear is tightly related to increased activity of amygdala. Additionally, other study also found that the increased activity of amygdala is also a sign of depression and anxiety. Not only amygdala is involved in fear emotion, but also several neurotransmitters are also taken part such as serotonin and GABA(Steimer, 2002).

Anger emotion in depression stems from narcissistic vulnerability, a concept which was proposed by Abraham. Anger can be felt by depressed individual due to an inclination towards hatred which results in guilt and anxiety. Therefore, it leads the individual to believe others hate the individual. Consequently, it will give rise to feeling of inadequacy and low self-esteem. Previous research had been conducted on the emotion of depression. Anger was the most emotion felt among patients with depression. Irritability and anger in depression patience are connected with severity of depression. Persistent sadness is one of the symptoms of depression. Fear emotion developed as well in depression and anxiety disorder(Busch,2009).The trait anger and anger management predict the depression severity (Kim et al, 2020) .

Our research had a small sample size and it needed to be replicated for quantitative methods. The facial action unit has validation issues. Previous research found inconsistent findings to validate facial action units as markers for depression. Our research did not directly measure emotions since we measured the AUs that were involved in facial emotions. Multimodality data involved the facial expression of depression might increase the validity of screening and diagnostic and reduce the misdiagnose Depression (Saver, 2007).

IV. CONCLUSION

There are two implications from our findings. Firstly, TEA interview revealed the implicit facial emotion during a conflict situation from the bifurcation point at the past, the equifinality of the present and imagination of the future. The development of implicit facial emotions in the TEA model of interview may help for a screening or diagnostic for depression.Furtherresearch can be done to replicate in a larger sample. Secondly, specific action units AU4,AU5,AU7 and AU15 that represent marker emotion of anger, sadness and fear are worth to validate.

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