



Agentive steadfastness as trait marker in relation to temperament and character

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ABSTRACT

Background: Agentive steadfastness was identified as a potential trait marker with which to anticipate prognostically that a patient will persevere steadfastly and take congruent action in facing the demands of living. Taken as an enduring expression of personality, this study investigated agentive steadfastness among adult social media respondents ($n = 511$) in relation to temperament and character as captured in Cloninger's psychobiological model of personality.

Methods: Participants recruited through snowball sampling on social media platforms, applied the 27-item Agentive Steadfastness Index (ASI) and the 240-item Temperament and Character Inventory (TCI-R-240).

Results: Agentive steadfastness was statistically predicted by the Self-directedness ($\beta = 0.634$), Self-transcendence ($\beta = 0.119$), Harm Avoidance ($\beta = -0.142$) and the Reward Dependence ($\beta = 0.071$) scales, accounting for 63.3 % of the variance in one stepwise regression model. In another stepwise model for the TCI-R-240 subscales, the Purposeful ($\beta = 0.359$), Anticipatory Worry ($\beta = -0.353$), and the Responsibility ($\beta = 0.259$) subscales accounted for respectively 56.8 %, 11.2 % and 2.8 % of the variance in ASI scores.

Limitations: Results are limited to adult social media respondents who were willing to participate.

Conclusions: Agentive steadfastness may serve as a trait marker of well-being and the good prognostic associations that have been established for high self-directedness, low harm avoidance, as well as resilience, and character strengths. It may be assessed clinically to anticipate prognostically the extent to which a patient will persevere steadfastly and take congruent action in facing the demands of living and adversity.

1. Introduction

When a patient proclaims, “I am OK”, this may mean various things including that a patient feels on the edge between “OK” and “not-OK”, desperately yearning to become “OK”, or plainly indicating improvement or recovery from, for example, an episode of depressive illness. A clinician may furthermore recognise when this is an accurate signal of a good prognosis and a patient is indeed “OK” in persevering steadfastly and taking congruent action in facing the demands of living and even adversity at times. Called agentive steadfastness, this is an enduring psychological trait and expression of personality, which is constituted by taking action from an inner sense of security, steadiness, being anchored, experiencing a meaningful past and anticipated future, acceptance, gratitude, positive expectations, self-trust and belonging, all in facing the demands of living including difficulties (Vosloo and Van Staden, 2023).

Although agentive steadfastness is taken as an expression of

personality, its relation to temperament and character as the two overarching dimensions of personality has not been reported before. In a psychobiological model of personality (Cloninger et al., 1993), temperament involves individual differences in automatic emotional reactions and habits (i.e., emotional predisposition) and character involves individual differences in self-concept about values and goals. Temperament and character are considered interrelated (Devebakan et al., 2018) in the sense that one's self-concept (i.e., character) determines the value or interpretation of a specific experience and consequently also one's emotional response and habits (i.e., temperament) (Gillespie et al., 2003).

Temperament is conceptualised as the dimension of one's personality that is hereditary, that manifests in infancy and is stable throughout life (Goldsmith et al., 1997; Shiner et al., 2012). Temperament refers to individual differences in one's automatic response to emotional stimuli that follows associate conditioning and procedural learning of habits and skill (Cloninger et al., 1993). Temperament traits include basic

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emotional response patterns, for example anger, fear and attachment. Cloninger et al. (1993) described four domains of temperament, which are harm avoidance, novelty seeking, reward dependence, and persistence.

Character refers to individual differences in one's voluntary goals and values based on insight, learning of intuition and concepts about ourselves, others and other objects (Cloninger et al., 1993). Character traits include our self-object relationship and originate in infants through parental attachment, in toddlers through self-object differentiation, and continue to mature throughout life. Cloninger et al. (1993) described three character domains, which are self-directedness, cooperativeness, and self-transcendence.

The psychobiological model of personality (Cloninger, 2003) is regarded as one of the most comprehensively researched theories of personality (Del Val et al., 2024; Richter and Brändström, 2009) extending to gene expression and epigenesis (Cloninger and Zwir, 2022). The Temperament and Character Index used in this model, was the strongest predictor of clinical health outcomes among 14 multidimensional personality assessment instruments, attaining an average correlation of $r = 0.53$ with six clinical indicators of psychopathology compared to the averages of the other personality measures ranging between 0.27 and 0.45 (Grucza and Goldberg, 2007). This model has had extensive influence in psychiatry and psychology (Farmer and Goldberg, 2008). Examples include research on the heritability (Ando et al., 2004; Heath et al., 1994), genetics (Cloninger and Silk, 1998; Herbst et al., 2000), the continuity (Cloninger and Svrakic, 2008) and the stability (Sigvardsson et al., 1987) of personality; the differentiation among various forms of pathological traits of personality (Svrakic et al., 1993); cross-cultural commonality versus specificity of personality traits (Švrakić et al., 1991); personality variability in families of disorders (e. g., eating disorders) (Fassino et al., 2002); the identification of distinct groups of personalities within specific diagnostic classes (Bohman et al., 1987; Cloninger, 1999); individual differences in associative and instrumental learning (Corr et al., 1995; Farmer et al., 2003); brain functions and processes associated with personality (Hansenne et al., 2000; Peirson et al., 1999; Zwir et al., 2023); response to therapies as a function of personality (Joyce et al., 2004; Sato et al., 1999); personality regulating gene expression (Del Val et al., 2024); and the polygenic risk for depression (Lavonius et al., 2024).

Considering these multiple and important connections that have been found in research on temperament and character, this study examined the relations between agentive steadfastness and the personality dimensions of temperament and character among adult social media respondents. It draws on data that were obtained during the validation study of the Agentive Steadfastness Index (ASI) (Vosloo and Van Staden, 2023) for which temperament and character analyses have not been reported before.

2. Methods

2.1. Participants and procedures

In a quantitative research design for data collection, analysis and interpretation, the study population was defined as active users of social media platforms, Facebook, Instagram and Twitter, who were 18 years and older from the general public and able to participate in English. Snowball recruitment was used, utilising the inherent peer network structure of social media platforms by requesting participants to recruit their contacts for participation in the study. A composite questionnaire was completed on Qualtrics that captured data for all variables and measuring instruments. Data were collected from November 2020 to April 2021. All procedures were ethically approved by the legally accredited Faculty of Health Sciences Research Ethics Committee of the University of Pretoria, South Africa.

The descriptive features of participants as reported before were as follows (Vosloo and Van Staden, 2023): Of the 511 participants, 89.4 %

were female, 80.9 % obtained a tertiary qualification and 54.6 % were married or in a relationship longer than six months. The average age of participants was 47.19 years (standard deviation = 13.837) and 68.9 % were employed or self-employed. These descriptive variables showed either no statistical associations with the ASI, or were of negligible effect when significant.

2.2. Measures of agentive steadfastness, temperament and character

The Agentive Steadfastness Index (see Supplementary material) is a 22-item measure yielded from a validation study of an initial 27-item version (Vosloo and Van Staden, 2023). Each item enquires about the preceding six months and self-reported ratings are recorded on a continuous interactive sliding scale comprising six unmarked points in between “never” to “always”. These are scored from 0 to 7 and higher total scores indicate more agentive steadfastness. Convergent validity with the closest related phenomena were supported by strong correlations with resilience ($r = 0.711$) and character strength ($r = 0.690$). Discriminant validity was supported by negative correlations with anxiety ($r = -0.604$) and ego-strength ($r = -0.249$). Its measuring an enduring trait over a period of six months was confirmed ($r = 0.760$). The 22-item ASI showed good internal consistency with a Cronbach's alpha coefficient of 0.938. An exploratory factor analysis yielded a clear three-factor model supported that the ASI reliably measured a coherent construct accounting for 49,31 % of the cumulative variance. These factors were labelled Stably Forwards: Secure and grateful from past to future; Inner- and Interrelatedness: Open and sensitive outwards; and Agentively Shaping Life by Goals. Good internal consistency was evidenced for the three factors with alpha values respectively being 0.930, 0.751 and 0.806. The standard error of measurement was 6.56 points, meaning that the ASI may be taken to yield a total score differing no >6.56 from the true score among the 155 theoretically possible total scores.

The Temperament and Character Inventory-Revised (TCI-R-240) is a 240-item self-report inventory that is the latest revised measure of Cloninger's theory of temperament and character, and comprises higher order subscales of personality (Goncalves and Cloninger, 2010). Items are answered on a 5-point Likert-scale format (i.e., 1 = “definitely false”; 2 = “mostly or probably false”; 3 = “neither true nor false or equally true and false”; 4 = “mostly or probably true”; and 5 = “definitely true”). The Cronbach's alpha value for all the items of the TCI-R-240 was reported at 0.90, and the two-week test-retest reliability coefficient was reported at 0.94 (Hansenne et al., 2005). Permission was obtained from the owners of the TCI-R-240, the Anthropedia Foundation, to use it in this study after purchasing it from them. The Foundation did the scoring of the data on the TCI-R-240 in this study.

2.3. Statistical analyses

To examine which aspects of the TCI-R-240 were associated with the ASI, Pearson's correlation testing between the ASI and the various scales and subscales of TCI-R-240 were performed. To examine the effect of the scales and the subscales of the TCI-R-240 on the ASI score, enter and stepwise regression analyses were performed. The probability threshold for a Type I error was set at 5 %. The strength of correlation coefficients was defined as follows: $r < 0.20$ is negligible; $0.20 < r < 0.40$ is weak; $0.40 < r < 0.60$ is moderate; $0.60 < r < 0.80$ is strong; and $r > 0.80$ is very strong (Van Staden et al., 2022). SPSS version 28 was used for the analyses.

3. Results

The Pearson's correlation coefficients pertaining between the ASI and TCI-R-240 scores are shown in Table 1. The ASI correlated strongly with the Self-directedness scale, moderately strong with the Cooperativeness and the Persistence scales, and weakly with the Self-

Table 1
Pearson's correlations coefficients between the ASI and the TCI-R scales and subscales.

n = 511	TCI-R scale (mean; SD)	TCI-R subscale	ASI	ASI factor: Stably forwards	ASI factor: Sensitive outwards	ASI factor: Shaping life by goals
			Mean = 110.93 SD = 26.36	Mean = 4.51 SD = 1.33	Mean = 4.47 SD = 1.13	Mean = 4.31 SD = 1.67
Pearson's correlation coefficients						
Temperament	Novelty seeking Mean = 2.90 SD = 0.43	Exploratory excitability	0.075	0.059	0.122	0.054
		Impulsiveness	0.345	0.318	0.320	0.294
		Extravagance	0.001	0.017	-0.013	-0.015
		Disorderliness	-0.062	-0.080	0.027	-0.071
	Harm avoidance Mean = 2.97 SD = 0.71	Anticipatory worry	-0.014	-0.029	0.041	-0.002
		Fear of uncertainty	-0.631	-0.640	-0.480	-0.434
		Shyness	-0.724	-0.745	-0.552	-0.447
		Fatigability	-0.393	-0.402	-0.301	-0.286
	Reward dependence Mean = 3.25 SD = 0.51	Shyness	-0.438	-0.429	-0.380	-0.322
		Openness to warm communication	-0.551	-0.566	-0.387	-0.384
		Sentimentality	0.210	0.161	0.334	0.086
		Attachment	-0.100	-0.158	0.104	-0.102
	Persistence Mean = 3.60 SD = 0.54	Dependence	0.357	0.314	0.427	0.207
		Attachment	0.263	0.236	0.309	0.119
		Dependence	-0.039	-0.061	0.043	-0.055
		Eagerness of effort	0.408	0.365	0.382	0.424
		Work hardened	0.353	0.331	0.322	0.331
		Ambitious	0.414	0.381	0.375	0.357
Perfectionist		0.345	0.299	0.310	0.444	
Self-directedness		0.276	0.230	0.290	0.311	
Responsibility		0.772	0.768	0.572	0.579	
Purposeful		0.715	0.725	0.490	0.526	
Cooperative-ness Mean = 3.92 SD = 0.45	Resourcefulness	0.753	0.727	0.568	0.689	
	Self-acceptance	0.624	0.612	0.499	0.464	
	Enlightened second nature	0.348	0.357	0.262	0.161	
	Social acceptance	0.616	0.621	0.448	0.448	
	Empathy	0.432	0.387	0.474	0.222	
	Helpfulness	0.357	0.315	0.389	0.208	
	Compassion	0.340	0.277	0.442	0.186	
	Pure-hearted conscience	0.387	0.348	0.437	0.204	
	Self-transcendence	0.351	0.337	0.338	0.165	
	Spiritual acceptance	0.180	0.164	0.180	0.068	
Self-transcendence Mean = 3.32 SD = 0.60	Self-forgetful	0.332	0.296	0.363	0.214	
	Transpersonal identification	0.131	0.099	0.188	0.096	
	Spiritual acceptance	0.387	0.347	0.417	0.253	
	Spiritual acceptance	0.269	0.249	0.276	0.162	

SD = standard deviation; correlation coefficients of a moderate strength or more, i.e., (-)0.4, are presented in bold.

Table 2
Regression analyses between the ASI and the TCI-R scales.

ASI = Dependent variable	TCI-R scale	Unstandardised coefficient		Standardised coefficient	Test statistic	Significance p-Value	
		B	Standard error	Beta			
Model 1: All TCI-R scales are entered as independent variables (ranked here by the absolute standardised coefficient value)	Self-directedness	29.833	1.908	0.688	15.634	<.001*	
	Self-transcendence	5.762	1.363	0.132	4.228	<.001*	
	Reward dependence	3.723	1.570	0.072	2.372	.018*	
	Harm avoidance	-4.676	1.539	-0.126	-3.039	.002*	
	Novelty seeking	2.581	1.863	0.042	1.385	.167	
	Persistence	-2.394	1.637	-0.049	-1.462	.144	
	Cooperativeness	-1.977	2.152	-0.034	-0.919	.359	
	(Constant)	-11.167	14.281	-	-0.782	.435	
	Model 2: Stepwise regression model with all significant independent variables	Self-directedness	27.483	1.638	0.634	16.781	<.001*
		Self-transcendence	5.192	1.257	0.119	4.131	<.001*
Harm avoidance		-5.259	1.418	-0.142	-3.710	<.001*	
Reward dependence		3.656	1.431	0.071	2.555	.011*	
(Constant)		-8.022	10.882	-	-0.737	.461	

ASI = Agentic Steadfastness Index; TCI-R = Temperament and Character Index.

* Statistically significant.

transcendence and the Reward Dependence scales of the TCI-R-240. It correlated negatively with the Harm Avoidance, and negligibly with the Novelty Seeking scales. The correlations of the three ASI factors with the TCI-R-240 scales followed the same pattern in most respects except that the correlation for the factor, Stably Forwards, was stronger than for the other two factors in its correlation with the Self-directedness scale, and its negative correlation with the Harm Avoidance scale. The correlation for the factor, Inner- and Interrelatedness was stronger than for the other factors in its correlation with the Reward Dependence scale, and the factor Agentively Shaping Life by Goals correlated weaker than the other factors with the Cooperativeness and the Self-transcendence scales.

For the TCI-R-240 subscales, the ASI correlated strongly with four of the five Self-directedness subscales, viz. the Purposeful, Responsibility, Resourcefulness, and Enlightened Second Nature subscales, and it correlated moderately with Worked Hardened. The ASI correlated negatively with all four subscales of Harm Avoidance.

Table 2 shows two regression models for the seven scales of the TCI-R-240. In the first model, the interactive effect of these scales on the ASI was statistically significant (sum of squares = 226,142.844; $df = 7$; mean square = 32,306.121; $F = 126.637$; $p < 0.001$) and it accounted for 63.8 % of the variance. The second model retained four of the scales in a statistically significant stepwise regression (sum of squares = 224,445;

$df = 4$; mean square = 56,111; $F = 218.4$; $p < 0.001$). This model accounted for 63.3 % of the variance, to which contributed the Self-directedness, the Self-transcendence, the Harm Avoidance and the Reward Dependence scales respectively 59.6 %, 2.1 %, 1.1 % and 0.5 %.

The standardised coefficients indicate statistically significant positive effects of Self-directedness, Self-transcendence and Reward Dependence as well as a negative effect of Harm Avoidance on the ASI score. These mean that a one standard deviation change on the specific TCI-R-240 scale will change the ASI score with that factor (i.e., the standardised coefficient) of the ASI's standard deviation. In the first model, this means an increase in the Self-directedness score of 0.61 (i.e., its standard deviation) will increase the ASI score with 0.668 (i.e., the standardised coefficient) of 26.36 (the ASI's standard deviation), that is an increase of 17.61. Calculated in the same way, the effects of the other TCI-R-240 scales are much smaller although still statistically significant: an increase of 0.60 in Self-transcendence, 0.51 in Reward Dependence, and 0.71 in Harm Avoidance scales will respectively result in an increase of 3.48, 1.90 and a decrease of 3.32 on the ASI score.

Table 3 shows two regression models for the 29 subscales of the TCI-R-240. In the first model, the interactive effect of these subscales on the ASI was statistically significant (sum of squares = 260,707.685; $df = 29$; mean square = 8989.92; $F = 46.122$; $p < 0.001$) and it accounted for

Table 3
Regression analyses between the ASI and the TCI-R subscales.

ASI = Dependent variable	TCI-R subscale	Unstandardised coefficient		Standardised coefficient	Test statistic	Significance p-Value
		B	Standard error	Beta		
Model 1: All TCI-R subscales are entered as independent variables (ranked here by the absolute standardised coefficient value)	Purposeful	12.236	1.270	0.378	9.632	<.001*
	Anticipatory worry	-11.453	1.610	-0.328	-7.112	<.001*
	Responsibility	7.637	1.362	0.227	5.609	<.001*
	Fear of uncertainty	4.404	1.211	0.132	3.636	<.001*
	Transpersonal identification	4.046	1.420	0.106	2.850	.005*
	Eagerness of effort	-3.407	1.488	-0.086	-2.289	.022*
	Fatigability	-1.978	1.110	-0.066	-1.782	.075
	Self-acceptance	-1.987	1.087	-0.060	-1.829	.068
	Empathy	1.956	1.505	0.046	1.300	.194
	Social acceptance	-1.997	1.625	-0.046	-1.229	.220
	Attachment	1.298	1.219	0.045	1.065	.288
	Work hardened	1.466	1.738	0.035	0.844	.399
	Helpfulness	1.946	2.014	0.034	0.966	.334
	Ambitious	-1.399	1.653	-0.033	-0.847	.398
	Resourcefulness	1.139	1.482	0.033	0.768	.443
	Shyness	-0.815	0.937	-0.032	-0.869	.385
	Enlightened second nature	1.028	1.563	0.027	0.658	.511
	Self-forgetful	0.861	1.369	0.021	0.629	.530
	Disorderliness	-0.840	1.259	-0.021	-0.667	.505
	Dependence	0.930	1.359	0.020	0.685	.494
	Pure-hearted conscience	-1.023	1.460	-0.020	-0.700	.484
	Impulsiveness	0.679	1.231	0.016	0.552	.582
	Compassion	0.529	1.065	0.016	0.497	.620
	Openness to warm communication	-0.571	1.723	-0.016	-0.331	.741
	Sentimentality	-0.534	1.480	-0.011	-0.361	.719
	Spiritual acceptance	-0.206	0.833	-0.007	-0.247	.805
	Extravagance	-0.193	0.973	-0.006	-0.198	.843
	Perfectionist	-0.037	1.642	-0.001	-0.022	.982
	Exploratory excitability	0.070	1.627	0.001	0.043	.966
(Constant)	45.427	15.256	-	2.978	.003*	
Model 2: Stepwise regression model with all significant independent variables	Purposeful	11.646	1.095	0.359	10.638	<.001*
	Anticipatory worry	-12.335	1.334	-0.353	-9.245	<.001*
	Responsibility	8.726	1.185	0.259	7.362	<.001*
	Transpersonal identification	4.165	1.024	0.109	4.067	<.001*
	Fear of uncertainty	3.642	1.012	0.109	3.600	<.001*
	Attachment	1.476	0.708	0.051	2.084	.038*
	(Constant)	35.062	8.064	-	4.348	<.001

ASI = Agentive Steadfastness Index; TCI-R = Temperament and Character Index.

* Statistically significant.

73.68 % of the variance. The subscales that contributed significantly in this model were the Purposeful, the Anticipatory Worry, the Responsibility, the Fear of Uncertainty, the Transpersonal Identification, and the Eagerness of Effort subscales. In contrast, the subscales that had the least effect on the ASI are indicated by the lowest absolute standardised coefficients (β) in this model. For example, the absolute β -values of the Exploratory Excitement, the Perfectionist, the Extravagance, and the Spiritual Acceptance subscales were all <0.01 .

The second model retained six of the subscales in a statistically significant stepwise regression (sum of squares = 256,919; $df = 6$; mean square = 42,820; $F = 221.3$; $p < 0.001$). This model accounted for 72.5 % of the variance, to which contributed the Purposeful, the Anticipatory Worry, and the Responsibility subscales respectively 56.8 %, 11.2 % and 2.8 %. The contributions of the other three statistically significant subscales were much less, viz. 0.8 %, 0.7 %, and 0.2 % by respectively the Transpersonal Identification, the Fear of Uncertainty, and the Attachment subscales.

4. Discussion

The results suggest that agentive steadfastness is mostly an expression of character, specifically self-directedness and self-transcendence. Self-directedness concerns the self as an autonomous individual from which derives personal integrity, honour, self-esteem, effectiveness, leadership, and hope (Cloninger et al., 1993). Agentive steadfastness was markedly related to being purposeful and responsible as main aspects of self-directedness. This empirically confirmed as it had been conceptualised in the development of the ASI (Vosloo and Van Staden, 2023) that a sense of purpose is a key indicator of agentive steadfastness in it being a central self-organising aim that organises and stimulates goals, manages behaviours, and provides as sense of meaning (Kim et al., 2014; McKnight and Kashdan, 2009; Sumner, 2020). The same applies for responsibility in so far as accountability was taken as a key indicator of agentive steadfastness, that is, the extent to which one takes responsibility for one's own behaviour, actions, decisions, and choices (Sedikides et al., 2002); and acting in awareness of being accountable for oneself, one's life and towards others, with freedom from restrictedness in being able to function autonomously and be free to take action without being limited by external or internal conflict (Leontiev, 2006; Van Staden, 2002).

Expressed in agentive steadfastness much less so than self-directedness, was the transpersonal identification aspect of self-transcendence that concerns a human capacity to expand personal boundaries intra-personally, inter-personally and trans-personally by which to connect within oneself, with others and nature (Cloninger et al., 1993). This relates to the inner strength aspect of agentive steadfastness, that is, to stand steady with both feet on the ground and be well-anchored in and connected to family, friends, society, and nature (Lundman et al., 2010; Reed, 1991).

Agentive steadfastness appeared furthermore as the antithesis of the harm avoidance temperament especially in its anticipatory worry aspect. The correlation coefficients of agentive steadfastness approximating zero with novelty seeking and the temperament traits of reward dependency and sentimentality, suggest that these aspects of temperament have less to do with and are more distant from agentive steadfastness.

The agentive steadfastness factor, Stably Forward, correlated strongly with high self-directedness and low harm avoidance. This configuration corresponds to “stability” and low neuroticism in various personality tests, supporting the descriptive labelling of this factor and the connections with the extensive literature on neuroticism (Cloninger et al., 2019). Moderate correlations of the factor, Sensitive Outwards, with low harm avoidance and high reward dependence match the profile described as sociable and outgoing in the TCI-literature, while its correlations with high self-directedness, high cooperativeness and high self-transcendence match the creative configuration. The latter

configuration predicted optimal functional brain connectivity (Zwir et al., 2023) and regulation of gene expression and optimal well-being (Del Val et al., 2024). Also the labelling of the third factor, Shaping Life by Goals, was supported by the strong correlation with the purposeful subscale of self-directedness, and its moderate correlation with the ambitiousness or high achieving subscale of persistence.

Scoring higher on agentive steadfastness correlates thus strongly with more self-directedness and less harm avoidance. High self-directedness and low harm avoidance have been highly predictive of well-being, less risk for illness and its risk factors, and better health outcomes and prognosis (Cloninger et al., 1993; Rosenstrom et al., 2012; Van Staden et al., 2023; Zohar et al., 2013). Self-directedness was strongly associated with all aspects of well-being regardless of interactions with other dimensions in two studies among 1102 participants (Cloninger and Zohar, 2011) and 1940 participants of the Cardiovascular Risk in Young Finns study (Josefsson et al., 2011). Within a 15-year longitudinal study of a general-population cohort ($n = 751$), lower self-directedness of one standard deviation predicted 7.6-fold number of future dysphoric episodes, and high harm-avoidance was associated with elevated dysphoria rates (Rosenström et al., 2014). In 631 adults from the general population, low self-directedness and high harm avoidance explained 52 % of the variance in the change in depressive features over a 12-month period (Cloninger et al., 2006). Patients with a major depressive disorder who had lower self-directedness scores were more likely to develop a subsequent episode and had a significantly shorter time to recurrence after remission (Asano et al., 2015). Harm avoidance was a negative predictor of treatment effectiveness in 11 studies ($n = 2527$) (Ovchinnikov et al., 2023), and was significantly higher in non-responding patients treated for depression (Gürü et al., 2022). Lower scores on self-directedness and higher scores on harm avoidance were also found in trait depression and anxiety (Lu et al., 2012), depression in pregnancy (Minatani et al., 2013), more severe anxious-depressive symptomatology in fibromyalgia (Leombruni et al., 2016), alexithymia (Terock et al., 2015), alcohol dependency and its treatment outcomes for (Arnaud et al., 2008; Avila Escribano et al., 2016), and panic disorder (Wachleski et al., 2008).

The strong correlations of agentive steadfastness with high self-directedness, low harm avoidance, and the moderate correlation with persistence, follow a configuration that is an established complex adaptive system that reflects resilience (Eley et al., 2013) and involves brain circuitry investigated for persistence (Cloninger et al., 2012). This complex adaptive system results from the integrating interactions between genetic and interpersonal networks by which temperament and character develop (Zwir et al., 2021). As for this configuration in a network of complex adaptive systems, agentive steadfastness may be understood as a manifestation resulting from personality development. This means that the measuring of agentive steadfastness captures a specific manifestation of personality but not, as the TCI-R-240 does, the fundamental aspects of personality.

Considering these previous findings for high self-directedness and low harm avoidance, the strong correlation of agentive steadfastness with these personality traits provides a promising hypothesis for testing the prognostic value of agentive steadfastness in subsequent studies, as that would scientifically strengthen the assessment of agentive steadfastness for clinical purposes. This hypothesis is also supported by the strong correlation found between agentive steadfastness and resilience (Vosloo and Van Staden, 2023), for resilience was previously found to correlate positively with self-directedness and negatively with harm avoidance (Kim et al., 2013).

That agentive steadfastness may sensibly be assessed for clinical prognostic purposes is furthermore supported by the strong correlation between agentive steadfastness and character strengths (Vosloo and Van Staden, 2023), for character strengths have been associated with various positive health outcomes and is well-established as a target in therapeutic interventions (Ghielen et al., 2018; Quinlan et al., 2012; Ruch et al., 2020). Being a positive trait and term, agentive steadfastness may

be assessed in clinical practice in congruence with positive psychiatry and psychology (Jeste et al., 2015; Seligman and Csikszentmihalyi, 2000), and strength-based approaches (Flückiger et al., 2023). As a trait that was found to remain stable over a six-month period (Vosloo and Van Staden, 2023), it may equip the clinician in providing psychoeducation, guidance, selecting therapeutic and preventative interventions, and promoting health in a person-centred orientation (Van Staden et al., 2023).

Further research is required into the relations of agentive steadfastness with various diagnostic categories and dimensions, responses to adversity and trauma, quality of life, longitudinal functioning, and responses to therapy. Since temperament and character dimensions of personality are connected to these clinical parameters, one may expect that these clinical parameters are underpinned by agentive steadfastness as an enduring psychological trait and expression of personality. Similarly, as pertaining for temperament and character, the relations of agentive steadfastness may be investigated for heritability (Ando et al., 2004; Heath et al., 1994), genetics (Cloninger and Silk, 1998; Herbst et al., 2000), the differentiation among various forms of pathological traits of personality (Svrakic et al., 1993), brain functions and processes associated with personality (Hansenne et al., 2000; Peirson et al., 1999; Zwir et al., 2023), response to therapies as a function of personality (Joyce et al., 2004; Sato et al., 1999), personality regulating gene expression (Del Val et al., 2024), and the polygenic risk for depression (Lavonius et al., 2024).

4.1. Limitations

The choice of a population invariably comes with limitations. The population of this study was defined as social media users, meaning that the results apply to other populations only by theoretical extrapolation if they apply at all. Similarities between users and non-users of social media may be grounds for this extrapolation, yet differences suggest that further study is required. An advantage of studying social media respondents is that this averts the limitations of sampling from a geographical region, a local community, a cultural group, an economic sector, or using students as participants as is commonly done in personality studies.

The study results are furthermore limited to willing participants. Higher levels of education and female gender are known to influence willingness to participate in these kinds of studies (Wilson and Musick, 1997). This profile also emerged in our study as is common in studies of this kind (Park et al., 2019). Age, gender, marital status, level of education and employment status were negligibly or not significantly associated with agentive steadfastness in this data set as reported before (Vosloo and Van Staden, 2023). However, the sample may be unusual regarding the temperament and character profile of participants, which would require further research for the potential influence of this.

5. Conclusions

These study results suggest that agentive steadfastness is mainly predicted by scoring higher in self-directedness and self-transcendence character traits, and lower in harm avoidance temperament. Persevering steadfastly and taking congruent action in facing the demands of living and adversity may thus be understood as the result of an integrative process in personality development, by which complex adaptive systems account for the interactions between genetic and interpersonal networks (Zwir et al., 2021). Agentive steadfastness correlated strongly with resilience in a previous study, which is thus congruent with another study's finding that being high in self-directedness and low in harm avoidance were predictive of resilience. Agentive steadfastness also correlated strongly with character strengths.

What may thus be expected reasonably, but is yet to be examined quantitatively, is that agentive steadfastness serves a trait marker that positively correlates with well-being and the good prognostic factors

that have been established for resilience, character strengths, high self-directedness and low harm avoidance. Insofar as this holds, agentive steadfastness may be assessed for clinical purposes and thereby corroborate a mere clinical intuition that a patient would persevere steadfastly and take congruent action in facing the demands of living and even adversity at times.

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Compliance with ethical standards

The study received ethics approval from the legally accredited Faculty of Health Sciences Research Ethics Committee. The study adhered to the stipulations of the 2013 version of the Declaration of Helsinki. All participants gave informed consent captured on an ethically approved study-specific informed consent document.

CRedit authorship contribution statement

Cristel Vosloo: Writing – original draft, Visualization, Software, Resources, Project administration, Investigation, Data curation, Conceptualization. **Werdie Van Staden:** Writing – review & editing, Visualization, Validation, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare they have no conflict of interest.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available owing to ethical restrictions as required by the research ethics committee that approved the study.

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Appendix A. Supplementary data

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References

- Ando, J., Suzuki, A., Yamagata, S., Kijima, N., Maekawa, H., Ono, Y., Jang, K.L., 2004. Genetic and environmental structure of Cloninger's temperament and character dimensions. *J. Personal. Disord.* 18 (4), 379–393.
- Arnau, M.M., Mondon, S., Santacreu, J.J., 2008. Using the temperament and character inventory (TCI) to predict outcome after inpatient detoxification during 100 days of outpatient treatment. *Alcohol Alcohol.* 43 (5), 583–588. <https://doi.org/10.1093/alcalc/agn047>.
- Asano, T., Baba, H., Kawano, R., Takei, H., Maeshima, H., Takahashi, Y., Suzuki, T., Arai, H., 2015. Temperament and character as predictors of recurrence in remitted patients with major depression: a 4-year prospective follow-up study. *Psychiatry Res.* 225 (3), 322–325.
- Avila Escibano, J.J., Barba, M.S., Pedrero, A.Á., Villarreal, A.L., Perez, J.R., Rodilla, M. R., García, E., 2016. Predictive capacity of Cloninger's temperament and character inventory (TCI-R) in alcohol use disorder outcomes. *Adicciones* 28 (3).
- Bohman, M., Cloninger, R., von Knorring, A.-L., 1987. The genetics of alcoholisms and related disorders. *J. Psychiatr. Res.* 21 (4), 447–452.
- Cloninger, C.R., 1999. *Personality and Psychopathology*. American Psychiatric Press.
- Cloninger, C.R., 2003. Completing the psychobiological architecture of human personality development: temperament, character, and coherence. In: Staudinger, U. M., Lindenberger, U.E.R. (Eds.), *Understanding Human Development: Dialogues With Lifespan Psychology*. Kluwer Academic Publishers, pp. 159–182.

- Cloninger, C.R., Silk, K., 1998. *Biology of Personality Disorders*. American Psychiatric Press, Washington DC, pp. 63–92.
- Cloninger, C.R., Svrakic, D.M., 2008. Personality disorders. In: Fatemi, S.H., Clayton, P.J. (Eds.), *The Medical Basis of Psychiatry*. Humana Press, pp. 471–483. https://doi.org/10.1007/978-1-59745-252-6_28.
- Cloninger, C.R., Zohar, A.H., 2011. Personality and the perception of health and happiness. *J. Affect. Disord.* 128 (1–2), 24–32.
- Cloninger, C.R., Zwir, I., 2022. Genetics of human character and temperament. *eLS* 3, 1–20.
- Cloninger, C.R., Svrakic, D.M., Przybeck, T.R., 1993. A psychobiological model of temperament and character. *Arch. Gen. Psychiatry* 50 (12), 975–990. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&dopt=Citation&list_uids=8250684.
- Cloninger, C.R., Svrakic, D.M., Przybeck, T.R., 2006. Can personality assessment predict future depression? A twelve-month follow-up of 631 subjects. *J. Affect. Disord.* 92 (1), 35–44.
- Cloninger, C.R., Zohar, A.H., Hirschmann, S., Dahan, D., 2012. The psychological costs and benefits of being highly persistent: personality profiles distinguish mood disorders from anxiety disorders. *J. Affect. Disord.* 136 (3), 758–766.
- Cloninger, C.R., Cloninger, K.M., Zwir, I., Keltikangas-Järvinen, L., 2019. The complex genetics and biology of human temperament: a review of traditional concepts in relation to new molecular findings. *Transl. Psychiatry* 9 (1), 290.
- Corr, P.J., Pickering, A.D., Gray, J.A., 1995. Personality and reinforcement in associative and instrumental learning. *Personal. Individ. Differ.* 19 (1), 47–71.
- Del Val, C., Diaz de la Guardia-Bolívar, E., Zwir, I., Mishra, P.P., Mesa, A., Salas, R., Poblete, G.F., de Erausquin, G., Raitoharju, E., Kähönen, M., 2024. Gene expression networks regulated by human personality. *Mol. Psychiatry* 1–20.
- Devebakan, N., Dogan, O., Ceylan, V., Akin, E., Kose, S., 2018. Relationship between temperament and character dimensions of personality and burnout and management in healthcare organization workers. *Psychiatry and Clinical Psychopharmacology* 28 (1), 73–79.
- Eley, D.S., Cloninger, C.R., Walters, L., Laurence, C., Synnott, R., Wilkinson, D., 2013. The relationship between resilience and personality traits in doctors: implications for enhancing well being. *PeerJ* 1, e216.
- Farmer, R.F., Goldberg, L.R., 2008. A psychometric evaluation of the revised Temperament and Character Inventory (TCI-R) and the TCI-140. *Psychol. Assess.* 20 (3), 281.
- Farmer, R.F., Field, C.E., Gremore, T.M., Chapman, A.L., Nash, H.M., Mayer, J.L., 2003. Passive avoidance learning among females as a function of Cloninger's temperament typology. *Personal. Individ. Differ.* 34 (6), 983–997.
- Fassino, S., Abbate-Daga, G., Amianto, F., Leombruni, P., Boggio, S., Rovera, G.G., 2002. Temperament and character profile of eating disorders: a controlled study with the Temperament and Character Inventory. *Int. J. Eat. Disord.* 32 (4), 412–425.
- Flückiger, C., Munder, T., Del Re, A., Solomonov, N., 2023. Strength-based methods—a narrative review and comparative multilevel meta-analysis of positive interventions in clinical settings. *Psychother. Res.* 33 (7), 856–872.
- Ghielen, S.T.S., van Woerkom, M., Christina Meyers, M., 2018. Promoting positive outcomes through strengths interventions: a literature review. *J. Posit. Psychol.* 13 (6), 573–585.
- Gillespie, N.A., Cloninger, C.R., Heath, A.C., Martin, N.G., 2003. The genetic and environmental relationship between Cloninger's dimensions of temperament and character. *Personal. Individ. Differ.* 35 (8), 1931–1946.
- Goldsmith, H.H., Buss, K.A., Lemery, K.S., 1997. Toddler and childhood temperament: expanded content, stronger genetic evidence, new evidence for the importance of environment. *Dev. Psychol.* 33 (6), 891.
- Goncalves, D.M., Cloninger, C.R., 2010. Validation and normative studies of the Brazilian Portuguese and American versions of the Temperament and Character Inventory—Revised (TCI-R). *J. Affect. Disord.* 124 (1–2), 126–133.
- Gruza, R.A., Goldberg, L.R., 2007. The comparative validity of 11 modern personality inventories: predictions of behavioral acts, informant reports, and clinical indicators. *J. Pers. Assess.* 89 (2), 167–187. <https://doi.org/10.1080/00223890701468568>.
- Gürü, M., Cengiz, G.F., Orsel, S., 2022. The relationship between Cloninger's temperament and character dimensions, and depression treatment outcome. *Online Turkish Journal of Health Sciences* 7 (3), 486–492.
- Hansenne, M., Pitchot, W., Pinto, E., Reggers, J., Papart, P., Anseau, M., 2000. P300 event-related brain potential and personality in depression. *Eur. Psychiatry* 15 (6), 370–377.
- Hansenne, M., Delhez, M., & Cloninger, C. R. (2005). Psychometric properties of the Temperament and Character Inventory—Revised (TCI-R) in a Belgian sample. *J. Pers. Assess.*, 85(1), 40–49.
- Heath, A.C., Cloninger, C.R., Martin, N.G., 1994. Testing a model for the genetic structure of personality: a comparison of the personality systems of Cloninger and Eysenck. *J. Pers. Soc. Psychol.* 66 (4), 762.
- Herbst, J.H., Zonderman, A.B., McCrae, R.R., Costa Jr., P.T., 2000. Do the dimensions of the temperament and character inventory map a simple genetic architecture? Evidence from molecular genetics and factor analysis. *Am. J. Psychiatry* 157 (8), 1285–1290.
- Jeste, D.V., Palmer, B.W., Rettew, D.C., Boardman, S., 2015. Positive psychiatry: its time has come. *J. Clin. Psychiatry* 76 (6), 14729.
- Josefsson, K., Cloninger, C.R., Hintsanen, M., Jokela, M., Pulkki-Raback, L., Keltikangas-Järvinen, L., 2011. Associations of personality profiles with various aspects of well-being: a population-based study. *J. Affect. Disord.* 133 (1–2), 265–273.
- Joyce, P.R., Mulder, R.T., McKenzie, J.M., Luty, S.E., Cloninger, C.R., 2004. Atypical depression, atypical temperament and a differential antidepressant response to fluoxetine and nortriptyline. *Depress. Anxiety* 19 (3), 180–186.
- Kim, J.W., Lee, H.-K., Lee, K., 2013. Influence of temperament and character on resilience. *Compr. Psychiatry* 54 (7), 1105–1110.
- Kim, E.S., Strecher, V.J., Ryff, C.D., 2014. Purpose in life and use of preventive health care services. *Proc. Natl. Acad. Sci.* 111 (46), 16331–16336.
- Lavonius, V., Keltikangas-Järvinen, L., Mishra, B.H., Sormunen, E., Kähönen, M., Raitakari, O., Hietala, J., Cloninger, C.R., Lehtimäki, T., Saarinen, A., 2024. Polygenic risk for depression predicting temperament trajectories over 15 years—a general population study. *J. Affect. Disord.* 350, 388–395.
- Leombruni, P., Zizzi, F., Miniotti, M., Colonna, F., Castelli, L., Fusaro, E., Torta, R., 2016. Harm avoidance and self-directedness characterize fibromyalgic patients and the symptom severity. *Front. Psychol.* 7, 186766.
- Leontiev, A.A., 2006. Sign and activity. *J. Russ. East Eur. Psychol.* 44 (3), 17–29.
- Lu, X., Chen, Z., Cui, X., Uji, M., Miyazaki, W., Oda, M., Nagata, T., Kitamura, T., Katoh, T., 2012. Effects of temperament and character profiles on state and trait depression and anxiety: a prospective study of a Japanese youth population. *Depress. Res. Treat.* 2012, 604684 <https://doi.org/10.1155/2012/604684>.
- Lundman, B., Aléx, L., Jonsén, E., Norberg, A., Nygren, B., Fischer, R.S., Strandberg, G., 2010. Inner strength—a theoretical analysis of salutogenic concepts. *Int. J. Nurs. Stud.* 47 (2), 251–260.
- McKnight, P.E., Kashdan, T.B., 2009. Purpose in life as a system that creates and sustains health and well-being: an integrative, testable theory. *Rev. Gen. Psychol.* 13 (3), 242–251.
- Minatani, M., Kita, S., Ohashi, Y., Kitamura, T., Haruna, M., Sakanashi, K., Tanaka, T., 2013. Temperament, character, and depressive symptoms during pregnancy: a study of a Japanese population. *Depress. Res. Treat.* 2013, 140169 <https://doi.org/10.1155/2013/140169>.
- Ovchinnikov, A., Vazagaeva, T., Akhupkin, R., Volel, B., 2023. Predictive capabilities of the Cloninger Temperament and Character Inventory (TCI) in evaluating the effectiveness of antidepressant pharmacotherapy. Systematic review and meta-analysis. *Neurology, Neuropsychiatry, Psychosomatics* 15 (1), 4–17.
- Park, K., Park, N., Heo, W., Gustafson, K., 2019. What prompts college students to participate in online surveys? *Int. Educ. Stud.* 12 (1), 69.
- Peirson, A., Heuchert, J., Thomala, L., Berk, M., Plein, H., Cloninger, C., 1999. Relationship between serotonin and the temperament and character inventory. *Psychiatry Res.* 89 (1), 29–37.
- Quinlan, D., Swain, N., Vella-Brodrick, D.A., 2012. Character strengths interventions: building on what we know for improved outcomes. *J. Happiness Stud.* 13, 1145–1163.
- Reed, K., 1991. Strength of religious affiliation and life satisfaction. *Sociol. Anal.* 52 (2), 205–210.
- Richter, J., Brändström, S., 2009. Personality disorder diagnosis by means of the Temperament and Character Inventory. *Compr. Psychiatry* 50 (4), 347–352.
- Rosenstrom, T., Jokela, M., Cloninger, C.R., Hintsanen, M., Juonala, M., Raitakari, O., Viikari, J., Keltikangas-Järvinen, L., 2012. Associations between dimensional personality measures and preclinical atherosclerosis: the cardiovascular risk in Young Finns study. *J. Psychosom. Res.* 72 (5), 336–343.
- Rosenström, T., Jylhä, P., Cloninger, C.R., Hintsanen, M., Elovainio, M., Mantere, O., Pulkki-Räback, L., Riihimäki, K., Vuori-lehto, M., Keltikangas-Järvinen, L., 2014. Temperament and character traits predict future burden of depression. *J. Affect. Disord.* 158, 139–147.
- Ruch, W., Niemiec, R.M., McGrath, R.E., Gander, F., Proyer, R.T., 2020. Character strengths-based interventions: open questions and ideas for future research. *J. Posit. Psychol.* 15 (5), 680–684.
- Sato, T., Hirano, S., Narita, T., Kusunoki, K., Kato, J., Goto, M., Sakado, K., Uehara, T., 1999. Temperament and character inventory dimensions as a predictor of response to antidepressant treatment in major depression. *J. Affect. Disord.* 56 (2–3), 153–161.
- Sedikides, C., Herbst, K.C., Hardin, D.P., Dardis, G.J., 2002. Accountability as a deterrent to self-enhancement: the search for mechanisms. *J. Pers. Soc. Psychol.* 83 (3), 592.
- Seligman, M.E., Csikszentmihalyi, M., 2000. Positive psychology: an introduction. *Am. Psychol.* 55 (1), 5–14. <https://doi.org/10.1037/0003-066X.55.1.5>.
- Shiner, R.L., Buss, K.A., McClowry, S.G., Putnam, S.P., Saudino, K.J., Zentner, M., 2012. What is temperament now? Assessing progress in temperamental research on the Twenty-Fifth Anniversary of Goldsmith et al. *Child Dev. Perspect.* 6 (4), 436–444.
- Sigvardsson, S., Bohman, M., Cloninger, C.R., 1987. Structure and stability of childhood personality: prediction of later social adjustment. *J. Child Psychol. Psychiatry* 28 (6), 929–946.
- Summer, R., 2020. The shape of a life: gender and its influence on purpose development. In: Burrow, A., Hill, P. (Eds.), *The Ecology of Purposeful Living Across the Lifespan: Developmental, Educational, and Social Perspectives*. Springer, Cham, pp. 149–164. https://doi.org/10.1007/978-3-030-52078-6_9149-164.
- Švrakić, D.M., Przybeck, T.R., Cloninger, C.R., 1991. Further contribution to the conceptual validity of the unified biosocial model of personality: US and Yugoslav data. *Compr. Psychiatry* 32 (3), 195–209.
- Svrakic, D.M., Whitehead, C., Przybeck, T.R., Cloninger, C.R., 1993. Differential diagnosis of personality disorders by the seven-factor model of temperament and character. *Arch. Gen. Psychiatry* 50 (12), 991–999.
- Terock, J., Janowitz, D., Spitzer, C., Miertsch, M., Freyberger, H., Grabe, H.J., 2015. Alexithymia and self-directedness as predictors of psychopathology and psychotherapeutic treatment outcome. *Compr. Psychiatry* 62, 34–41.
- Van Staden, C., 2002. Linguistic markers of recovery: theoretical underpinnings of first person pronoun usage and semantic positions of patients. *Philos. Psychiatry Psychol.* 9 (2), 105–121.
- Van Staden, W., Dlagnekova, A., Naidu, K., 2022. Validity and reliability of the Staden schizophrenia anxiety rating scale. *Diagnostics* 12 (4), 831.

- Van Staden, C.W., Cloninger, C.R., Cox, J., 2023. Holistic framework in person centered medicine. In: *Person Centered Medicine*. Springer, Cham, pp. 85–103.
- Vosloo, C., Van Staden, W., 2023. Validity and reliability of the agentive steadfastness index. *Int. J. Psychol.* <https://doi.org/10.1002/ijop.13098>.
- Wachleski, C., Salum, G.A., Blaya, C., Kipper, L., Paludo, A., Salgado, A.P., Manfro, G.G., 2008. Harm avoidance and self-directedness as essential features of panic disorder patients. *Compr. Psychiatry* 49 (5), 476–481.
- Wilson, J., Musick, M., 1997. Who cares? Toward an integrated theory of volunteer work. *Am. Sociol. Rev.* 694–713.
- Zohar, A.H., Cloninger, C.R., McCraty, R., 2013. Personality and heart rate variability: exploring pathways from personality to cardiac coherence and health. *Open J. Soc. Sci.* 1 (06), 32.
- Zwir, I., Del-Val, C., Arnedo, J., Pulkki-Råback, L., Konte, B., Yang, S.S., Cloninger, C.R., 2021. Three genetic–environmental networks for human personality. *Mol. Psychiatry* 26 (8), 3858–3875.
- Zwir, I., Arnedo, J., Mesa, A., Del Val, C., de Erausquin, G.A., Cloninger, C.R., 2023. Temperament & character account for brain functional connectivity at rest: a diathesis-stress model of functional dysregulation in psychosis. *Mol. Psychiatry* 28 (6), 2238–2253.