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A network model for human playfulness during war

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This novel study investigates adult playfulness during recent wartime in the Middle East using the OLIW model of playfulness and the concept of fantastic reality ability to utilize imagination in response to stress and trauma. Through a network analysis approach, we explore the relationships between playfulness, resilience, and clinical symptoms among N = 1511 Israeli participants. Our findings highlight the nuanced dynamics of playfulness amidst adversity. Notably, playfulness—particularly lighthearted playfulness—emerges as closely linked to resilience, suggesting its role as a coping mechanism during war. Additionally, the centrality of dissociation and transcendence within the network underscores their importance as potential targets for therapeutic interventions. Furthermore, our analysis highlights the potential roles of playful imagination and control, advocating for the testing of tailored interventions to enhance coping strategies and mental health outcomes in war-affected populations. This study offers valuable insights into responses to adversity, with implications for promoting resilience and mitigating the impact of trauma.

From the dawn of time mammals and humans have played. Amidst the chaos of war, individuals, families, and communities often turn to play and playfulness as a means of navigating the harsh realities they face[1–3]. Recently, the United Nations recognized the importance of play, affirming it as a fundamental right for children—an acknowledgment of its universal significance[4]. While the importance of play and playfulness as well as development in children's daily lives has long been recognized, the role of playfulness in adults remains understudied, despite growing interest within the field of psychology[5]. Imagine individuals sheltering from bombardment in cramped bomb shelters, yet finding solace and connection through playful activities that defy the logic of their circumstances. From the trenches of World Wars I and II to the harrowing tales of survival during the Holocaust, accounts abound of people harnessing their playfulness as a means of coping and resilience during war[2,6–8].

The ability—or lack thereof—of survivors to reclaim a sense of play offers profound insights into the depth of their trauma and their journey toward healing[6]. Despite its evident importance, the study of playfulness during wartime and trauma has received scant attention[3,9,10]. Our research endeavors to narrow this gap, offering a nuanced examination of adult playfulness within the context of war that, to the best of our knowledge, has not been explored before. While play refers to observable behavior, playfulness denotes individual differences in the tendency to have a playful approach to life and engage in playful behavior. To advance understanding of trait playfulness under adversity, we examined its role in reframing reality to cope with stressors, using a sample of individuals exposed to war. We set out to study adult playfulness and its relationships with resilience and clinical symptoms during the recent wartime in the Middle East. By examining these relationships, we aim to shed light on the adaptability of adult behavior under duress, and on how playfulness may contribute to resilience and to coping with trauma in the face of war. Understanding these specific dynamics can offer valuable insights regarding responses to adversity, ultimately supporting efforts to promote resilience and mitigate the effects of trauma.

Playfulness as a mechanism for resilience and coping with stress and trauma

Adult playfulness refers to individual differences in how people (re)frame situations to make them entertaining, and/or personally interesting, and/or stimulating[11]. While early definitions of playfulness emphasized its hedonic or pleasurable aspects, growing evidence suggests it extends beyond enjoyment. Playfulness can be employed in serious, and not only in fun-oriented or leisurely contexts including stressful environments[7–10,12]. Playfulness serves as a mechanism for resilience and coping with stress and trauma, aiding in the construction of coherent

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traumatic narratives and the development of adaptive coping strategies[3]. Recent research during the COVID-19 pandemic has highlighted the importance of building psychological resources such as playfulness to enhance adaptive coping in stressful situations[13,14].

Individuals with high levels of playfulness exhibit inner motivation, goal-setting, and an inclination towards pretense and activity[15]. This capacity for imaginative play is integral to the development of mentalization—the ability to understand and interpret thoughts, emotions, and fantasies[16]. While playfulness fosters positive emotions and effective self-regulation, as well as key components of resilience[1,17], individuals with post-traumatic stress disorder (PTSD) may exhibit reluctance to engage in play or to be playful due to hypervigilance and depression-related symptoms[2]. This complexity emphasizes the need for a multifaceted understanding of playfulness in adulthood.

OLIW model of playfulness

The OLIW model of adult playfulness as a trait[11] offers a multi-faceted structural model that distinguishes between the facets of *Other-directed* (i.e., liking to engage playfully with others), *Lighthearted* (i.e., preferring improvisation overplanning; seeing life generally as a playground), *Intellectual* (i.e., liking complexity over simplicity; liking challenges and wordplay), and *Whimsical* playfulness (i.e., having a preference for unusual activities, objects, interests, or individuals). People show differential profiles in the sense that some people are characterized by high expressions in one facet, but not necessarily in others—or any other combination of the four facets. The model and its measurement have been investigated and replicated well across countries, including Australia, Brazil, Germany, Israel, and the USA[18–21].

Using the OLIW-model, playfulness has been studied across various domains. For example, the facets are robustly related to indicators of well-being and positive emotions, mental health, physical activity, life satisfaction, and lower inclinations to personality pathology, as well as to the PERMA domains of well-being. This is not limited to younger populations but has also been observed in samples of middle-aged and older individuals[21–25]. They also relate to experiences in romantic couples of young, middle, and old ages in terms of relationship satisfaction, love styles, and partner similarity[26,27]; for an overview see[28]. Playfulness has been theoretically and empirically linked to facilitating positive emotions[29] and contributing to bonding, trust, and intimacy in social relations[28]. Beyond these direct associations, research has examined potential mediators that might contribute to understanding the relations between playfulness and indicators of positive psychological functioning. There, initial research has shown that playfulness contributes to coping with stress[15,30,31], even in times of a global crisis such as the COVID-19 pandemic[32].

Self-directed activities that encouraged playfulness in terms of the OLIW-model were associated with improvements in well-being and amelioration of depression, providing empirical support for the notion that playfulness can serve as a mechanism contributing to positive psychological functioning. A placebo-controlled randomized study has shown that playfulness can be trained with short daily exercises (e.g., counting daily playful incidents)[25]. The self-reported changes in playfulness (OLIW-facets) for the training group did also go along with increases in well-being and reduction of depressive symptoms (tested for up to three months), thus supporting the claim that playfulness has merits for mental health in non-clinical populations. In the context of psychotherapy, playfulness of patients and therapists robustly predicts a good client-patient relationship and therapy outcomes[33–35], suggesting that the role of playfulness might also be of importance in clinical settings[3]. Whether playfulness itself is malleable[36] or whether the effects observed in placebo-controlled intervention studies[25] are transient remains an open question for further research. However, we argue that investigating playfulness offers several key benefits: It allows us to explore the associations between playfulness and trauma-related variables in individuals exposed to traumatic experiences and it presents the potential for leveraging playfulness to achieve positive therapeutic outcomes through training and stimulation[3]. The present study will help expanding the understanding of the way people differ in their reactions to trauma-inducing situations such as acts of war whether playfulness and imagination might help mitigating or effectively managing these reactions.

Fantastic reality model: imagination and trauma

Fantastic reality (FR) serves as an intermediate realm between reality and imagination; this is particularly evident in the context of stressors and trauma. Amidst the chaos and trauma of conflict, individuals often seek refuge in the imaginative realms of FR to navigate the harsh realities of war zones. Within this realm, individuals can freely engage in exploration, playfulness, and the creation of alternative scenarios to cope with the stress and uncertainty of wartime experiences. Consider a family burdened by the horrors of war: Within the sanctuary of their imagination, they may envision pleasant future scenarios, engage in artwork or in role play to gain insights into perspectives, or generate creative flexible strategies for survival and resilience. This freedom from the confines of reality empowers individuals to explore novel possibilities and devise solutions for the challenges imposed by war[2,3].

In the context of war, the application of fantastic reality ability (FRA) and its factors—control, playfulness, transcendence, and coping—becomes paramount. FRA is defined as the capacity to utilize imagination in response to stress, uncertainty, or trauma[14,37]. *Control* involves actively shaping and regulating one's imaginative content, while *playfulness* encourages an open, creative, sociable, and spontaneous approach to the use of imagination. FRA playfulness uniquely emphasizes the creative, social, and adaptive use of imagination in response to stress and trauma, while OLIW playfulness focuses more on general playful attitudes manifested through its four facets. Prior research has shown that the FRA facet of playfulness and those of trait playfulness are positively associated but not redundant[38]. *Transcendence* entails the ability to detach from the real world and immerse oneself deeply within the imaginative realm, whereas *coping* pertains to using imaginative processes for problem solving and emotion regulation. Findings suggest that FRA is strongly correlated with measures of resilience, ego resilience,

adaptive emotion regulation and playfulness[14,37,38]. The FRA factors provide a more nuanced picture, whereby three factors are considered 'resilient factors' (i.e., playfulness, control, and coping;[14,37]) and even characterize the resilient personality prototype[39]. By understanding the significance of nuanced playfulness and imagination within the framework of war, we gain insights into its profound implications for coping, psychological well-being, and ultimately, for the resilience of individuals amidst conflict.

The aim of this study is to explore playfulness during war while adopting a nuanced approach, utilizing network analysis methodology. Traditionally, research has often focused on understanding phenomena at the individual component level, but recent advancements in network science have highlighted the importance of studying the organization of these components within a system[40]. By employing network analysis, which offers a growing approach for modeling associations between variables in psychological science[41,42], we aimed to explore the complex relationships between playfulness, FRA, clinical symptoms, and resilience in the midst of conflict and war.

We collected the data for the present study in the weeks following the October 7th 2023 attacks, during a period of full-scale war and widespread psychological distress in Israel[43]. This extraordinary context offered a unique opportunity to examine the role of playfulness and imagination under acute collective threat. Given the prevalence and importance of post-traumatic stress symptoms, dissociation, and resilience during war[44], it is critical to assess these constructs alongside playfulness and FRA to better understand their potential interrelationships. Through this innovative approach, we sought to uncover nuanced relationships that may have been previously overlooked, ultimately contributing to a deeper understanding of well-being in war settings.

Method

Sample and data collection

Our sample comprised $N = 1511$ Israeli participants between the ages of 18 and 89 years ($M = 46.9$, $SD = 17.3$). About half of the sample were men (47.5%) and half women (52.5%). The majority were married (59.4%); 27.9% were single, 11.1% were divorced, and 1.5% were widow(er)s. The educational status was high, with 46.9% pursuing or holding an academic degree. The remainder of the sample were either high school graduates (41.4%) or had studied for at least eight years. With regard to religiosity, 58.4% identified as secular, 20.5% as traditional, 13.4% as religious, and 7.7% as ultra-orthodox (see electronic supplementary A for a detailed breakdown of demographics). This sample is representative of the Jewish population in Israel according to age, gender, and geographic distribution[45].

We collected data online with the assistance of MIDGAM, a company specializing in Internet-based research infrastructure. MIDGAM facilitated participant recruitment from a diverse pool of individuals interested in voluntary or remunerated online studies. On December 25th, 2023, invitations to participate were distributed to a panel of 17,995 Israelis. Non-probability-quota sampling was utilized to ensure representation across demographic variables such as gender and age, reflecting the population composition of the country. Within three days, responses from 1518 participants were obtained, constituting 8.4% of the invited panel. To maintain data quality, our questionnaire included attention checks, leading to the exclusion of seven participants. This study was approved by the Institutional Review Board at Tel Hai Academic College, Kiryat Shmona, Israel (IRB, 24-6/2023). All experimental protocols were sanctioned, and all methods were conducted in compliance with relevant guidelines and regulations. Informed consent was obtained from all participants.

Instruments

Fantastic reality ability

We used the *Fantastic Reality Ability MEasurement* (FRAME;[37]) questionnaire to assess imagination abilities in response to stress and trauma. The FRAME contains 21 items that assess a general factor and the four facets of *coping* (e.g., "I use my imagination to prepare myself for difficult or stressful tasks"), *control* (e.g., "I control my imagination, and I can imagine anything I want"), *playfulness* (e.g., "I enjoy taking part in social games"), and *transcendence* (e.g., "I find myself sitting staring into space, thinking of nothing, unaware of the passage of time"). Participants responded to the items on a 7-point Likert-type scale (1 = *strongly disagree*; 7 = *strongly agree*). Rubinstein and colleagues provided robust evidence for the good psychometric properties (e.g., retest-correlations ≥ 0.60 for up to 7 months) and evidence on the nomological and factorial validity, including replicability of the measurement model across independent samples (see also[14]).

Playfulness

The OLIW-S questionnaire assesses four facets of playfulness, each of which has three items. Participants respond to each item on a 7-point Likert-type response scale (1 = *strongly disagree*; 7 = *strongly agree*). Example items are "Also as an adult I still like to play good natured, funny tricks on others; to play small good-natured pranks on others" (*other-directed*), "I don't worry about most of the things that I have to do, because there will always be some kind of a solution" (*lighthearted*), "If I have to learn something new under time pressure, I try to find a playful approach to the topics—this helps me learning" (*intellectual*), and "I do not generally like to allow myself to be categorized and have my own style in many respects" (*whimsical*). The OLIW-S has been found to show good convergence with the full OLIW questionnaire, internal consistencies, robust retest-stability ($rs \geq 0.67$ for up to three month-intervals), self-other agreement, and structural stability, including measurement invariance between the Hebrew and German versions (see[20] and[24]). We assessed playfulness with the Hebrew language version of the OLIW-S questionnaire by Rubinstein et al.[20]; original version:[24].

Resilience

The six-item Brief Resilience Scale (BRS;[46]) assesses resistance to adverse life events, adaptation, and the ability to bounce back from stressful events. A sample item is "I usually come through difficult times with little trouble."

Respondents indicate their agreement with each on a 5-point Likert scale (1 = *strongly disagree*; 5 = *strongly agree*). The BRS is characterized by a unidimensional measurement model, good internal consistencies, retest-reliability (≥ 0.62 for up to three months), and robust evidence on nomological validity. The BRS has been translated into numerous languages and is a standard measure for the assessment of resilience.

Post-traumatic stress

We assessed post-traumatic stress symptoms with the *PTSD Checklist for DSM-5* (PCL-5;[47]). The PCL-5 contains 20 items that ask for symptoms that characterize PTSD according to the DSM-5 (e.g., "In the past month, how much have you been bothered by repeated, disturbing, and unwanted memories of the stressful experience?"). The items are answered on a 5-point rating scale (0 = *not at all*; 4 = *extremely*). The PCL-5 items are computed as a total score indicating the general appearance of post-traumatic stress, and four facets: *intrusion* (e.g., "repeated, disturbing dreams of the stressful experience"), *avoidance* (e.g., "avoiding memories, thoughts, or feelings related to the stressful experience"), *Negative Changes in Cognition and Mood (NC)* (e.g., "feeling distant or cut off from other people"), and *arousal* (e.g., "having difficulty concentrating"). The PCL-5 is a standard instrument for the assessment of post-traumatic stress symptoms and there is robust evidence for its good psychometric properties, reliability, 4-cluster model, and external validity (for an overview, see[48]).

Dissociative experiences

We used the *Brief Dissociative Experiences Scale* (DES-B)—modified for DSM-5 by Dalenberg and Carlson[49]. The DES-B is a standard measure to assess dissociative experiences and severity of dissociative symptoms by practitioners and researchers alike. The scale provides a total score of responses to its eight items. A sample item is "People, objects, or the world around me seem strange or unreal," and participants rate each item with regard to the frequency of experiences (0 = *not at all*; 4 = *more than once a day*). Given the prevalence of dissociative symptoms in trauma-exposed populations, such as those affected by war, the DES-B is a valuable tool for assessing dissociation in these contexts[50]. The literature has provided robust evidence on the reliability and validity of the original DES (for overviews, see[49,51,52]) and more evidence has been gathered recently for the modified DSM-5 version (e.g.,[53]).

Data analysis

This research utilized a cross-sectional quantitative design to investigate the relationships between its study variables. We computed preliminary data analyses with SPSS version 28 (Armonk, NY: IBM Corp.). Initial assessment involved evaluating internal consistency reliability of the main variables through Cronbach's alpha coefficient. Descriptive statistics were computed for the main variables (FRAME, OLIW-S, BRS, PCL-5, and DES-B) to provide a comprehensive overview of their distributions and central tendencies. Pearson's product–moment correlation coefficients were then calculated to discern relationships between these variables. Given the large sample size, which renders even very small effect sizes statistically significant, we followed published recommendations for interpreting bivariate correlation coefficients in individual differences research[54]. Accordingly, we interpreted coefficients of $r \geq 0.10$, 0.20, and 0.30 as small, medium, and large effect sizes, respectively, and reported only bivariate Pearson correlations of $r \geq 0.10$.

We used network analysis (NA) to examine the multivariate relationships between our study variables. We computed the NAs in JASP (version 0.18.0.0; JASP Team, 2023), which leveraged R's *bootnet* and *qgraph* packages[55] to visualize the relationships among the variables. For each test, we assumed a type-I-error rate of 5%. To allow for better interpretation of the magnitudes of effects, we computed effect sizes.

NA offers a contemporary framework for modeling multivariate data in psychological science. Prior research has used NA across sub fields of psychology, providing insights into personality, psychotraumatology, PTSD and beyond[40,56]. Contrary to traditional latent variable modeling, NA directly estimates relationships among all variables, offering a visual representation of multivariate dependencies that would otherwise remain hidden. Notably, NA portrays edges as partial correlation coefficients, reflecting connections between nodes (in our case, psychological constructs) A and B after controlling for all other edges in the network.

To address the estimation of numerous parameters and mitigate false positive connections, we employed the least absolute shrinkage and selection operator (LASSO;[57]), setting very small edges to zero. Specifically, we used the extended Bayesian information criterion graphical least absolute shrinkage and selection operator (EBICglasso), which estimates partial correlations between all variables and shrinks absolute weights to zero. This process slightly biases edge weights but ensures that small edge weights are precisely zero, alleviating the issue of multiple comparisons. The EBICglasso hyperparameter was chosen using the Bayesian information criterion (BIC), which accounts for both model complexity and fit[58].

We estimated the network structure using the R package *qgraph*. Initially, we used data from the general population sample ($N = 1{,}511$), incorporating FRAME and OLIW facets alongside clinical symptomology and resilience in the estimation procedure (N1). The cor auto function of the qgraph package was utilized to automatically compute appropriate correlations for different variable types (polychoric, polyserial, or Pearson). Centrality estimation revealed the most central factors for each network, including node strength, closeness centrality, betweenness centrality, and expected influence[55].

NAs provide statistical parameters, but also relies on the interpretation of visualizations of networks. In such visualizations positive edges are shown in blue and negative edges in red. Further, thickness and saturation of the interconnecting lines indicate connection strength between variables. Nodes with stronger and/or more connections are depicted closer together. We set the maximum edge value across all networks to 0.50, which allowed for comparisons of edge saturation and thickness, while we used a minimum value of 0 in all networks to enhance the interpretability of the graphs.

Results

Descriptive statistics and correlations

The inspection of our study measures' descriptive statistics shows that the means and *SD*s are comparable to prior research, showing no robust deviations from typical findings (see ESM B). In terms of internal consistency, the measures utilized in this study demonstrated generally good reliability, with Cronbach's alpha values ranging from 0.56 to 0.97 across scales (ESM Table B). The intellectual playfulness facet yielded a reliability score that was lower than expected (α = 0.28), likely due to a technical error: the item presentation was preceded by a general definition of playfulness focused on enjoyment (fun-loving, positive), which potentially biased participants' responses.

Descriptive statistics confirmed that participants were substantially impacted by the ongoing war, as evidenced by elevated psychological distress: approximately 60% reported PTSD symptoms ranging from *mild* to *very severe*, and over 75% experienced at least *mild* dissociative symptoms. Nonetheless, most individuals exhibited normative levels of psychological resilience (see ESM Table C).

We examined the bivariate correlations between our study variables. Table 1 gives the correlations between the FRAME, OLIW facets, and our study variables. Playfulness and control demonstrated moderate positive correlations with resilience (*r*s = 0.32 and 0.29, respectively). In contrast, transcendence showed positive associations with dissociative experiences ($r = 0.41$, $p < 0.001$). Transcendence also showed a moderate positive association with PTSD symptoms ($r = 0.27$, $p < 0.001$). Overall, the bivariate correlations between coping, playfulness, control, and most other study variables were generally of small to negligible effect sizes (*r*s ≤ 0.13).

Regarding the OLIW facets, we found that all facets relate to greater reports of resilience, with *r*s between 0.16 and 0.41, and, thus, varying effect sizes. The latter was the strongest observed correlation, between lighthearted playfulness and resilience. Concerning dissociative experiences, we found that only other-directed playfulness showed a relevant correlation of $r = 0.19$. While other-directed and intellectual playfulness were unrelated to reports of post-traumatic stress, lighthearted playfulness showed small negative, and whimsical small positive, associations (see Table 1).

To learn more about the unique relations between our study variables, we computed the multivariate NA next.

Network and centrality analysis

Network model

Figure 1 shows the 13-node network structure in the general sample (N1). Our inspection of the graph and weight parameters (wts) indicated that the nodes showed the expected clustering (i.e., the strongest edges in the network emerged between nodes of higher-order variables), reflecting the expected interrelations between our study variables, with wts between 0.00 and 0.33. However, we found one exception, as the FRAME transcendence factor showed a positive edge (wts = 0.28) with dissociation and a negative one with resilience (wts = −0.10). The nodes reflecting clinical symptoms displayed mostly positive correlations with each other (0.00 < wts < 0.45) and were predominantly unrelated or negatively correlated with other nodes (see Table 2 for more details). Our main analysis showed that the lighthearted OLIW node exhibited the closest proximity and strongest edge to resilience in our model (wts = 0.25). For the FRAME, playfulness and control demonstrated positive edges with resilience (wts = 0.11 and 0.09).

In our novel exploration of this cross-sectional network, we delved into the centrality dynamics of its various nodes. Among these interconnected elements, dissociation and FRAME transcendence emerged as central nodes. Furthermore, transcendence displayed the highest closeness centrality, followed closely by all FRAME facets, resilience, and dissociation, suggesting their proximity to other nodes and potential influence in the network. Regarding strength, NC PTSD symptoms cluster and FRAME playfulness were found to have the highest levels, highlighting their substantial position within the network. Additionally, in terms of NA expected influence, NC PTSD symptoms cluster, and FRAME playfulness showed the highest scores, followed by FRAME control and PTSD hyper-arousal cluster, underscoring their notable role within the network (see Fig. 2 and ESM D and E).

	Fantastic reality ability					Playfulness			
	Coping	Playfulness	Control	Transcendence	Total	Other-directed	Lighthearted	Intellectual	Whimsical
Resilience	.07**	.32***	.29***	−.08**	.18***	.20***	.41***	.17***	.16***
Dissociation	.13***	.01	.04	.41***	.21***	.06*	.04	.04	.19***
PTSD	.13***	−.06*	−.09**	.27***	.10***	−.01	−.12***	.02	.14***
Intrusion	.13***	−.05	−.07*	.24***	.10***	.00	−.09***	.04	.11***
Avoidance	.12***	−.06*	−.06*	.20***	.08**	−.02	−.08**	−.01	.08**
NC	.10***	−.08**	−.10***	.25***	.07**	−.03	−.14***	.00	.13***
Arousal	.13***	−.03	−.06*	.27***	.12***	.02	−.10***	.03	.14***

Table 1. Correlations between fantastic reality and study variables controlled for age and gender. *$p < .05$; **$p < .01$; ***$p < .001$. Two-tailed. NC = negative changes in cognition and mood (PTSD cluster).

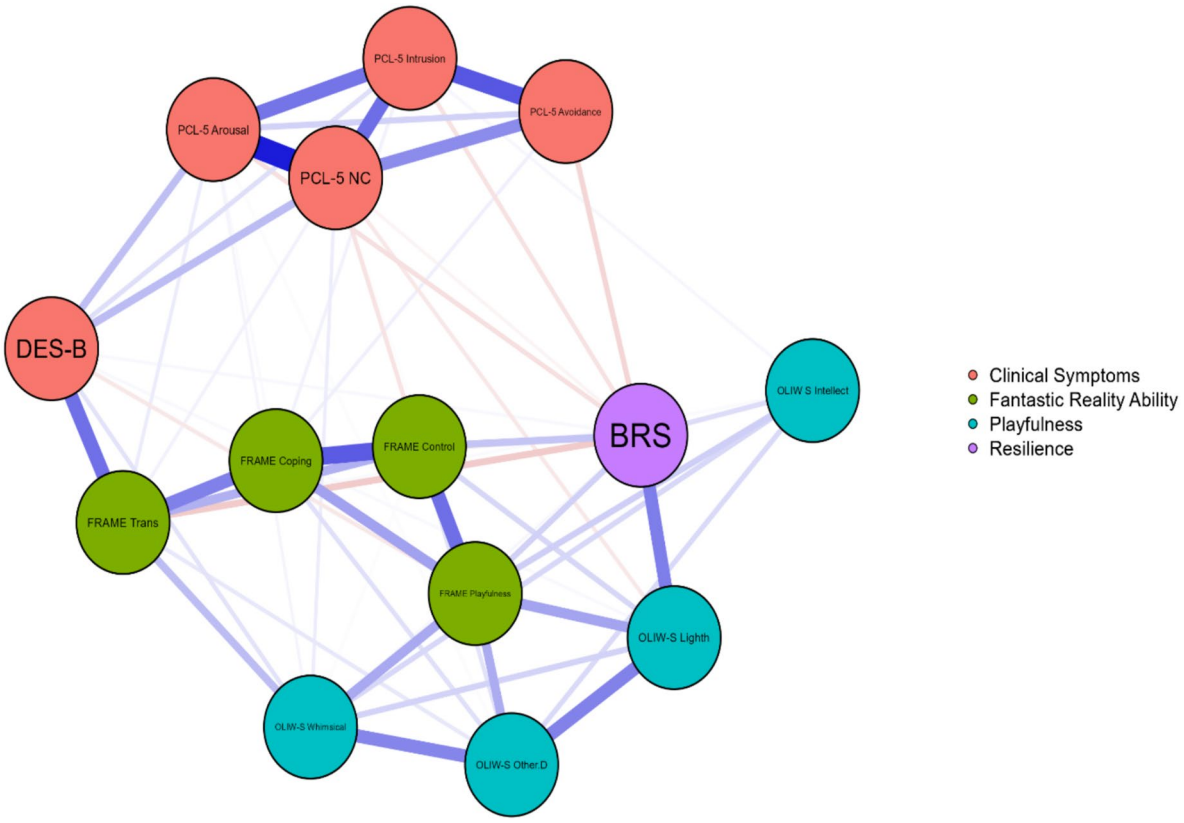

Fig. 1. Network analysis model of main study variables general public sample (N1; N = 1511). The network structure is a Gaussian graphical model, which represents a network of partial correlation coefficients selected via EBICglasso. *Trans = FRAME Transcendence, Lighth = OLIW Lighthearted, Other.D = OLIW Otherdirected, NC = negative changes in cognition am mood cluster, DES-B = Dissociation.* Blue lines represent positive associations, red lines negative ones, and the thickness and brightness of an edge indicate the association's strength.

Variables	Network													
	FRA CP	FRA PL	FRA CL	FRA TRS	O	L	I	W	BRS	PCL-5 IN	PCL-5 AV	PCL-5 NC	PCL-5 AR	DES-B
FRAME coping	–													
FRAME playfulness	.18	–												
FRAME control	.32	.28	–											
FRAME transcendence	.25	.00	.15	–										
OLIW-S other-directed	.06	.16	.05	.04	–									
OLIW-S lighthearted	.00	.18	.08	.00	.25	–								
OLIW S intellectual	.00	.09	.00	.01	.07	.00	–							
OLIW-S whimsical	.00	.17	.01	.13	.24	.09	.08	–						
BRS (Resilience)	− .03	.09	.11	− .10	.00	.25	.07	.01	–					
PCL-5 intrusion	.03	.00	.00	.00	.00	.00	.02	.00	− .06	–				
PCL-5 avoidance	.03	.00	.00	.00	.00	.00	.00	.00	− .08	.33	–			
PCL-5 negative cognition	.00	.01	− .05	.03	.00	− .04	.00	.04	− .02	.28	.23	–		
PCL-5 arousal	.01	.00	.00	.04	.01	.00	.00	.02	− .06	.27	.09	.45	–	
DES-B	.00	− .05	.00	.03	.00	.01	.00	.05	− .01	.06	.00	.13	.13	–

Table 2. N1 weights matrix. N1 Weights for study variables are presented in Table 2. Top row short codes represent the parallel variable presented in first column.

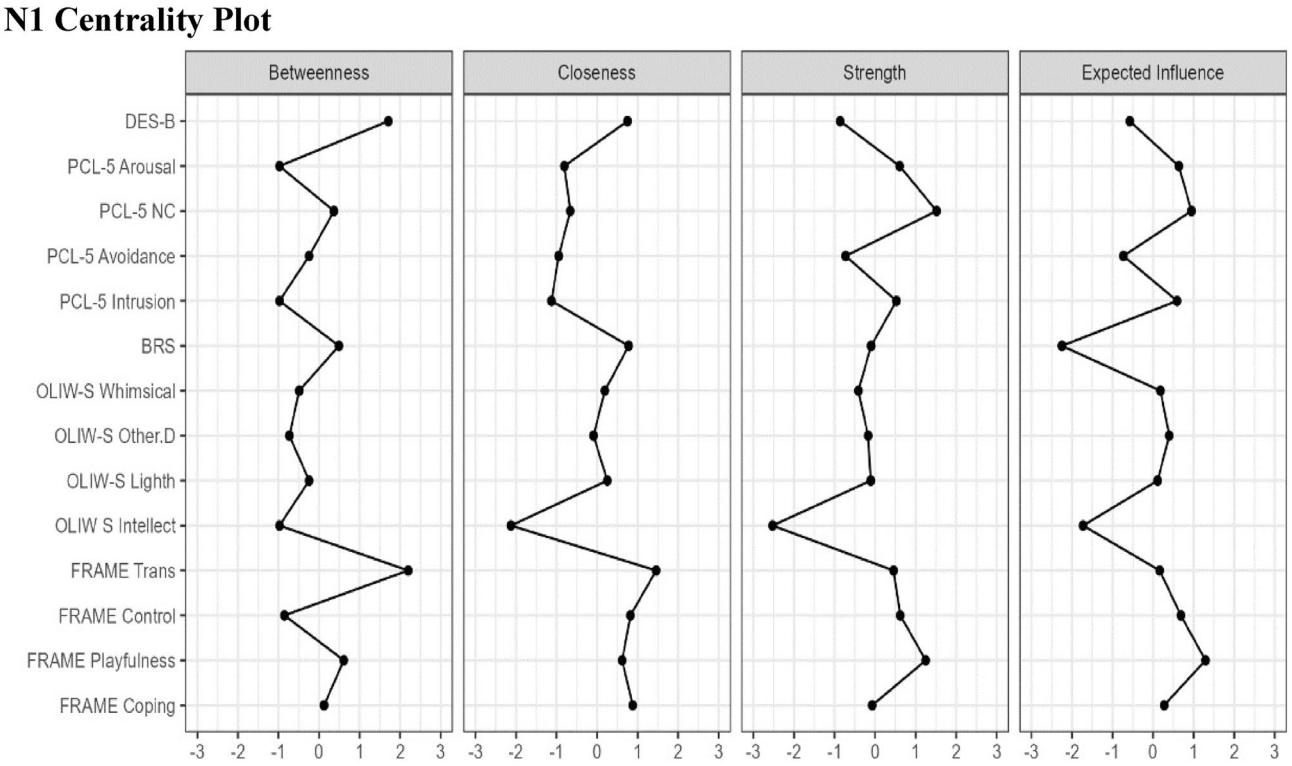

Fig. 2. Centrality plot for N1. Betweenness, closeness, node strength and expected influence centrality estimates for N1 are presented. See Fig. 1 for descriptions of the short codes.

Discussion

The present study aimed to advance understanding of the roles of different types of playfulness and imagination in relation to post-traumatic stress experiences and resilience. Using a representative sample of participants that were subjected to war, our findings allow us to draw initial conclusions about imagination and playfulness and dealing with post-traumatic stress. Findings reflect widespread psychological distress within the general population, consistent with recent research conducted in Israel following the attacks on October 7th 2023, which also reported elevated levels of PTSD and related clinical symptoms[43]. In short, this study highlights the importance of studying variables that are typically considered non-essential during times of crisis. Our findings suggest that playfulness and imagination may serve as important pathways for coping under duress. These findings provide a crucial foundation for future research investigating the impact of these understudied variables on coping with adverse life events, including experiences such as war and trauma.

The observed findings for playfulness (particularly lighthearted playfulness), imagination (particularly FRA control and playfulness), and resilience provide evidence of their associations. While bivariate correlations indicated general trends, our exploratory model and initial interpretations were based on the NA. We argue that future research on their causal mechanisms will help deepen our understanding of the pathways and dynamics between playfulness, FRA, and the psychopathology of trauma. For example, considering the limitations of this research, it could be argued that specific aspects of playfulness and imaginative abilities might act as a coping mechanism to deal with stressful environments and situations that individuals cannot control. In particular, playfulness might allow individuals to reframe stressful situations, forge communal ties during adversities and provide distractions from frightening and distressful circumstances, fostering a short-timed sense of control and a positive outlook about future development[3,9,10,59,60]. This potentially provides solace or escape in the face of adversity. This aligns with the NA, where lighthearted playfulness emerged as the closest node to resilience, suggesting a strong positive relationship. The lighthearted facet, characterized by a cheerful and carefree approach (e.g., "seeing life as a game") may facilitate psychological resilience by promoting flexible perception of events, reconstruction, positive emotions, and a sense of humor, even in the face of adversity. This aligns with theories that emphasize the beneficial aspects of playfulness in adults, including the capacity to broaden-and-build positive emotions as well as stress buffering, reframing reality, and enhanced coping capabilities, as well as recent resilient theories emphasizing regulatory flexibility [31,32,38,60–62].

The positive NA edges between FRA playfulness and control with resilience lend support to the notion that that playfulness, social imagination use, and a sense of personal imaginal control and efficacy are crucial in stressful contexts. Overall, the data fit well to earlier findings about the contribution of playfulness to stress coping[14,32,38,39].

While we do not have data on the causal relationships, it could be argued that playfulness and imagination can contribute to positive psychological functioning beyond escapism and temporary distraction. The importance of

social relationships and connectedness during times of crises hardly needs mentioning. However, playful activities could promote social connection and a sense of community, fostering feelings of support and belonging, both vital for resilience and coping under harsh circumstances and insecurity about the future. Clinical observations and recent research indicate that playfulness may also emerge during extreme stress or prolonged conflicts as a means of coping with an unbearable reality[6,8,9]. In reality, life is often dictated by external influences, menacing the individual to an extent where their significance is eclipsed. Yet, through the prism of imagination and playful exploration, individuals can forge a semblance of autonomy. This grants them a renewed sense of control, fostering the belief that they are architects of their own destinies, even as an illusion of control. The literature supports the notion that during stressful situations, playfulness could foster active engagement, elicits positive emotions, supports the regulation of negative feelings, and contributes to a sense of control and self-motivation[2,3,10,13,38]. However, our data do not allow to provide conclusions about causality. Thus, an alternative explanation could be that individuals with higher resilience naturally engage in a playful approach, using the 'resilient FRA factors' as coping mechanisms, as suggested by previous research on personality prototypes[39]. While more longitudinal research is necessary to delineate the protective versus risk factors associated with playfulness, the findings from this study emphasize its potential pivotal role, warranting further investigation.

The network-based nuanced approach we used in our study is central to multivariate exploratory data, as component constructs may point in differing directions, with some correlating with PTSD and others with resilience. We found that the FRA transcendence factor could potentially serve as a mediator among the key variables. Although transcendence is typically considered a positive aspect of human experience, in the context of trauma it might take on a more nuanced role, bridging the gap between direct experiences and coping outcomes. A negative relationship with resilience and a positive association with PTSD and dissociation should also be considered for transcendence, as we observed in this study. This is similar to earlier findings in which transcendence showed strong associations with clinical symptoms and was distinct from resilience[14,37–39]. Therefore, understanding how transcendence interacts with symptoms and resilience could offer deeper insights into coping mechanisms in war-affected populations.

Network model centrality

The findings from our NA offer valuable insights into the complex inter-relations of psychological constructs and responses under wartime stress. Notably, FRA playfulness and the NC PTSD symptoms cluster were prominent, exhibiting the highest levels of strength within our network. This suggests that these factors are notably central in the psychological landscape of this network model. FRA playfulness indicates that adaptive playful imagination and behaviors may serve as potential coping mechanisms, possibly helping to mitigate the adverse psychological impacts of war. The significant role of NC points to the substantial effects that war-related stressors can exert on mental health, impacting mood, thought processes, and cognitive functions[63]. Although moderately associated with one another, FRA playfulness and NC seem to be central as potential pathways in this model. Additionally, these variables, along with FRA Control and the PTSD hyper-arousal cluster, were central in terms of NA expected influence. This centrality highlights their role for both individual psychological well-being and within the broader network.

Again, no causality can be inferred but one interpretation of our findings might be that FRA playfulness and control could have a stabilizing effect, in the sense of potentially softening the impact of more harmful PTSD symptom clusters. Their strategic positions within the network should stimulate future research that examines whether enhancing these aspects could propagate beneficial effects throughout the network. Thus, potentially bolstering resilience and reducing vulnerability to adverse psychological states.

Theoretical and practical implications

While the discussed implications are grounded in this exploratory network analysis, as well as previous research[14,37–39] and clinical experience[2,3,8], they should be regarded as initial insights that require further clinical and longitudinal validation research. Our data extend the existing literature by illustrating how the facets of playfulness and imagination intersect in a network of psychological responses to war. The central position of dissociation and transcendence within the network suggests that therapeutic interventions in war-affected populations might benefit from addressing these aspects directly. For instance, therapies could aim to integrate transcendence in a way that supports active coping and resilience, rather than detracting from it.

The central roles of FRA playfulness and control in our model also point to their potential benefits and future research should examine them as focal points for therapeutic interventions. Strengthening FRA playfulness and control may allow for opportunities to interrupt the progression of severe PTSD symptoms. Moreover, the strong linkage between lighthearted playfulness and resilience should be further explored, because it can offer a compelling argument for the inclusion of lighthearted playfulness-enhancing strategies in psychological interventions. Preliminary evidence from placebo-controlled randomized trials, which investigated the effects of brief daily engagement with playful activities (e.g., journaling about three playful experiences or reflecting on daily instances of playfulness), suggests that cultivating playfulness in terms of Proyer's OLIW-model[11] can be effectively stimulated and may alleviate symptoms of depressiveness[25]. Further research could lead to the development of more effective prevention strategies and more targeted interventions that utilize playfulness as a mechanism to enhance resilience and improve outcomes for individuals facing conflict and related stressors[3,10,13,64]. Overall, interventions aimed at enhancing OLIW model's lighthearted playfulness[11] and the use of FRAME model's-controlled imagination[3] might be effective in bolstering resilience among populations exposed to trauma. Future research should investigate the conditions under which playfulness exerts the strongest effects, which may provide valuable insights for interventions.

Limitations and future directions

Our findings must be interpreted with limitations in mind. First, our data are of cross-sectional nature. As discussed, we cannot draw conclusions about causality and processes that contribute to dealing with war-related stressors. Longitudinal data allowing us to examine the baseline levels in the study variables before the outbreak of the war would be needed to examine how playfulness and imagination predict stress and resilience over time and after traumatic experiences. Secondly, our data are based on self-reports; thus, they might be affected by shared method variance[65] and overestimate correlations between our study variables. The PCL-5 total score demonstrated high internal consistency ($\alpha = 0.96$), which, while within the typical range, warrants cautious interpretation. The use of alternative data sources such as ratings by knowledgeable others and clinicians' ratings of participants' stress symptoms would be desirable to strengthen the validity of the self-reports. Thirdly, findings on the four facets of playfulness await replication with the full version of the questionnaire, as the abbreviated OLIW-S[24] is limited in assessing the full breadth of the facets. Additionally, the low alpha for the intellectual playfulness facet suggests that results regarding this factor should be interpreted cautiously, as less reliable measures may also capture unwanted variance. Fourthly, our study involved a representative sample of Jewish Israelis. However, generalizing the findings to other cultures or subcultures requires caution and sensitivity. Further cross-cultural research is necessary to explore these questions in a broader context. Finally, these results should be treated as exploratory, as this is the first-time network analysis has been conducted with these variables in the setting of war.

Conclusion

The use of network models in our study has widened the understanding of the complex relationships between psychological factors like playfulness and imagination in the context of traumatic stress. Such models allow us to dissect the nuanced ways in which these factors are inter-related within the psyche of individuals exposed to war, providing a clearer picture of potential therapeutic targets. Our model presents the potential role of lighthearted playfulness, and imaginative use, such as FRA control and FRA playfulness, in coping with traumatic stress amidst war. Lighthearted playfulness appears particularly related to resilience, suggesting that encouraging such traits or states could be beneficial in psychological interventions. These findings advocate for a nuanced approach in therapy and resilience programs, focusing on the cultivation of these specific aspects of playfulness and imagination to enhance mental health and coping strategies in populations affected by conflict.

Data availability statement

The study materials and data used for this article can be accessed at [https://doi.org/https://doi.org/10.7910/DVN/NJNASB].

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Author contributions

All authors (i.e., Dori Rubinstein, Mooli Lahad, Limor Aharonson-Daniel, Kay Brauer and René T. Proyer) have made substantial, direct, and intellectual contributions to the work. They were involved in the conception and design of the study, data collection, analysis, and interpretation of the results. All authors have participated in drafting the manuscript, critically revising it for important intellectual content, and approving the final version for publication.

Declarations

Competing interests

The authors declare no competing interests.

Additional information

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