

Psychological costs of technological warfare: Moral injury, identity disruption and IR-level consequences in drone/RPA operations and cyber warfare personnel — evidence from the 2019–2022 conflict period

Vijender Kumar¹, Dr. Kuldeep Kumar Mehendiratta²

¹ Research Scholar, Department of Social Science, Kurukshetra University, Haryana, India

² Professor, Research Supervisor, Department of Social Science, Kurukshetra University, Haryana, India

Abstract

Technological warfare in modern times has created a psychologically distinct group of combatants whose moral injuries, identity dislocation, and institutional attitudes are systematically different to those of conventional combat personnel- yet whose individual-level psychological profiles combine into quantifiable international relations (IR)-level impacts on civil-military relations, escalation propaganda, and strategic risk-taking. This is interdisciplinary research that introduces the first comparative psychological study of drone/remotely piloted aircraft (RPA) operators, cyber warfare workers and conventional combat veterans based on the 2019-2022 conflict period. The quantitative survey data (N=420; three groups, n=140 each) collected with the help of validated scales, such as the Moral Injury Events Scale (MIES, adapted), the PCL-5 (PTSD Checklist to DSM-5), the Military Identity Questionnaire (MIQ), and the Civil-Military Trust Index (CivMil Trust), were supplemented with 22 semi-structured qualitative interviews, which were analysed using NVivo thematic coding. Results indicate that the operators of drones/RPA were found to experience the most moral injury (M=4.87 vs. 3.42 when compared to conventional combat, $d=1.37$, $p<.001$), due to the so-called moral distance paradox, i.e. physical distance between one and the violence and close visual proximity to the effects of violence. Cyber warfare occupational-related participants reported the greatest experience of cognitive dissonance (M=5.12) and experience of algorithmic accountability gap (M=5.12). The first empirical data on an I-level-to-IR-level psychological pathway in technologically mediated warfare was confirmed by structural equation modelling (SEM; CFI=.947, RMSEA=.053). Exposure to COVID-19 greatly increased the moral injury of drone/RPA operators and cyber warfare practitioners ($\Delta R^2=.071$, $p<.001$), with cyber warfare practitioners reporting a unique sense of epistemic exhaustion of managing COVID-era information operations as an occupational extension. The quantitative results were validated and extended by six qualitative themes, saturated at n=18 of 22 interviews. The research paper presents and empirically validates the phenomenon of the so-called Technological Combatant Psychology as a theoretically and clinically distinct phenomenon with direct implications for military mental health policy, governance of civil-military relations, and management of crisis escalation.

Keywords: Moral injury, drone warfare, RPA operators, cyber warfare psychology, military identity, civil-military relations, escalation advocacy, technological combatant psychology, COVID-19 information operations PTSD

Introduction

The technologically mediated modern warfare has never been on the same level as it is now in the history of military. Between 2019 and July 2022, a period delimited by the active deployment of US Global Hawk and MQ-9 Reaper drone platforms, the orchestrated cyber and information operations of Russia in Ukraine, and the rising AI-enabled intelligence-surveillance-reconnaissance (ISR) architecture of China, the human beings who fight these wars are no longer associated with just a single recognisable psychological type ^[1, 7]. The conventional infantry soldier, the drone operator controlling a Hellfire missile strike with a Nevada trailer, and the cyber warfare practitioner disrupting critical infrastructure with a classified facility in Fort Meade inhabit radically different moral, cognitive and institutional environments - yet the military psychology, policy and international relations (IR) theory have largely continued to treat the combatant as a monolithic subject ^[8, 18].

The effects of this analytical collapse can be seen at various levels. At the personal and clinical level, the operators of drone/RPA present psychological images that do not fit well into either the classical combat-related PTSD or the work-related burnout: they report a unique constellation of moral

injury-emotional and spiritual damage caused by acting against personal moral code or failing to prevent moral transgression ^[19, 25]-and identity disruption brought about by the radical non-correspondence between their experience and the cultural script of the warrior ^[6], ^[22, 28]. The cyber warfare practitioners inhabit an even more new psychological space: they are involved in offensive operations with potentially huge real-world consequences and experience almost complete physical and often moral disengagement with those consequences- a configuration which creates high cognitive dissonance, algorithmic accountability gaps, and institutional distrust ^[29, 38].

These individual psychological profiles at the IR level do not just have clinical implications, but will add up to institutional and political impacts which IR theory has not yet theorised. Drone operators, when the moral injury systematically amplifies their escalation advocacy, as a mechanism of moral legitimisation of their already accomplished actions, makes the composition of a technologically mediated combatant force of a state a variable of IR, not just a military psychology variable ^[39, 48]. When the systemic weakening of the civil-military trust of professionals in cyber warfare leads to the systematic

undermining of the civilian control systems that govern strategic risk-taking, then the institutional governance implications of the rise of cyber warfare as a state instrument will be the ones that current strategic theory fails to consider^[49, 57].

This paper fills these gaps by providing a mixed-method study (N=420 quantitative survey; n=22 qualitative interviews) comparing drone/RPA operators, cyber warfare personnel, and conventional combat veterans over the 2019-2022 period. The study makes five original contributions: (i) it demonstrates that the psychological burden of technologically mediated warfare was significantly moderated by exposure to COVID-19; (ii) it shows that exposure to COVID-19 significantly modulated the psychological burden of technologically mediated warfare; (iii) it demonstrates that exposure to COVID-19 significantly moderated the psychological burden of technologically mediated warfare; (iv) it establishes that exposure to COVID-19 significantly moderated the psychological burden of technologically mediated warfare; and (v) it introduces Technological Combatant Psychology (TCP) as a theoretically and empirically distinct construct within military psychology.

Literature Review

1. Technological Mediation of Modern Warfare: The 2019–2022 Context

The 2019-2022 period is a qualitative turning point in the technological mediation of war across all three of the major great power competitors. As of 2020-2021 (as of 2022, RPA operators make up the fastest-growing segment of the US Air Force combat workforce^[9, 10]. The United States has over 11,000 active drone/RPA aircraft, with the USAF MQ-9 Reaper crews operating in at least 20 countries simultaneously as of 2020-2021^[9, 10]. The coordinated use of cyber operations, information warfare and electronic warfare against Ukraine, starting with escalated operations in 2021 and culminating in the February 2022 invasion, deployed an ecosystem of cyber and information warfare personnel estimated at several thousand dedicated practitioners within the structures of GRU, FSB and SVR^{[12], [39], [58, 65]}. Throughout 2019-2022, China continued to accelerate its AI-enabled ISR and information warfare capabilities under unified command through the Strategic Support Force (SSF)^{[7], [36], [66, 70]}. Psychological consequences of this rapidly growing technological mediation were recorded in the literature but never systematically pursued in the comparative, IR-grounded manner this paper has attempted.

2. Moral Injury Theory and Military Personnel

Introduced by Shay^[2] as the damage that occurs when a person in authority commits what is not right in a high-stakes situation, and theoretically elaborated by Litz *et al.*^[1] as the psychological, social, cultural and spiritual impact of perpetrating, failing to prevent, or bearing witness to acts that transgress deeply held moral beliefs. Morally, empirically, moral injury is linked to shame, guilt, spiritual struggle, and disillusionment with institutions that are perceived to have compromised the moral commitments of the individual^{[4], [15]}. Theoretically, it is different from PTSD, although the two are co-occurring: PTSD is a fear-based disorder that occurs due to a threat to life, whereas

moral injury occurs due to moral transgression or witnessing^{[1], [28]}.

In the case of the drone/RPA operators, the moral injury literature identifies a certain and paradoxical pattern: the physical safety goes together with the intimate visual exposure to the effects of violence. According to Chappelle *et al.*^[10], US Air Force drone operators report post-traumatic stress, emotional exhaustion, and occupational burnout at an equal rate, as pilots do in conventional combat zones, even though they do not face any personal physical threat. The paradox is the so-called paradox of the screen intimacy, like high-resolution sensors bring operators into proximate visual relationship with targets and casualties in a manner that ground-based targeting (indirect fire, e.g.) does not, and the lack of physical jeopardy removes the fear-based justification which typically mediates combatant moral processing^{[9], [22]}. The current study hypothesises the empirical uniqueness of this pattern of moral injury versus both traditional combat PTSD and cyber warfare psychological profiles.

3. Identity Disruption in Non-Conventional Combat Roles

Military identity, internalization of warrior role identity as a core self-concept, has been well-researched in traditional combat settings^{[6], [16]}. The warrior identity gives psychological integrity, ethical justification of violence, and societal status in the culture of the military institutions. The operators of drone/RPA technologies and participants in cyber warfare occupy an institutional void: they perform combat functions but are unable to possess the signifiers of the warrior identity, both experiential and cultural: physical presence in a combat zone, direct exposure to a personal threat, peer recognition of the combatant rather than the technician identity^{[22], [35]}. It is the identity anomaly that produces what this paper will refer to as identity fragmentation- the disjuncture between role function and cultural identity script with quantifiable effects on psychological integration and institutional fidelity.

The study of cyber warrior identity is even less advanced. Cyber warfare practitioners are not well studied as a discrete psychological group, and the identity challenges that they face are qualitatively different than those of the drone operators: they may never know whether their activities have caused physical harm, they are working in contexts where attribution of impact is inherently ambiguous, and the cultural scripts of understanding identity as a cyber warrior are entirely nascent^{[20], [39]}. Buchanan^[61] records that the ambiguity of attribution in cyber operations, which are operationally viable, yet institutionally unrecognised, creates certain patterns of cognitive dissonance that explain the patterns of cognitive dissonance identified in the qualitative data presented in this paper.

4. Civil-Military Relations and Escalation Advocacy

The literature on civil-military relations has been largely concerned with macro-level institutional structures: civilian control measures, military professionalism and strategic advisory relationships^{[30], [31]}. Not as well understood is the micro-level process by which individual combatant psychological conditions, most especially the moral injury and identity disruption that have been reported in this study, are aggregated into institutional attitudes that influence the quality of civil-military discourse and the propensity toward

escalation advocacy. The agency theory of civil-military relations is the agency theory that Feaver predicts that military agents who believe that civilian principals have failed to meet their obligations of adequate institutional recognition of those obligations will shift towards what he terms shirking -reduced compliance with civilian authority, and increased preference for autonomous military action. The profiles of moral injuries and identity disruption that are recorded in this paper are exactly the preconditions to the existence of this dynamic in technologically mediated warfare situations.

The operationalisation of strategic risk-taking preference employed in this study, which is known as escalation advocacy, has been a subject of study in the traditional deterrence literature [35], [69] but not in the context of combatant psychology that is technologically mediated. The hypothesis of the present paper, according to which moral

injury, via a legitimization-seeking mechanism, elevates the escalation advocacy within the ranks of drone/RPA operators, is a novel theoretical contribution: one that proposes that dissonance about past lethal actions, through a legitimization-seeking mechanism, elevates the escalation advocacy within the ranks of drone/RPA operators, possesses direct implications on the advice pipeline of civil-military advice through which strategic decisions are made.

Theoretical Framework: Technological Combatant Psychology (TCP) Framework

Figure 1 presents the Technological Combatant Psychology (TCP) Framework that organises the theoretical architecture of the study across four analytical layers between the role of warfare and the results of the IR through individual psychological responses mediated by institutional and COVID-19 contextual variables.

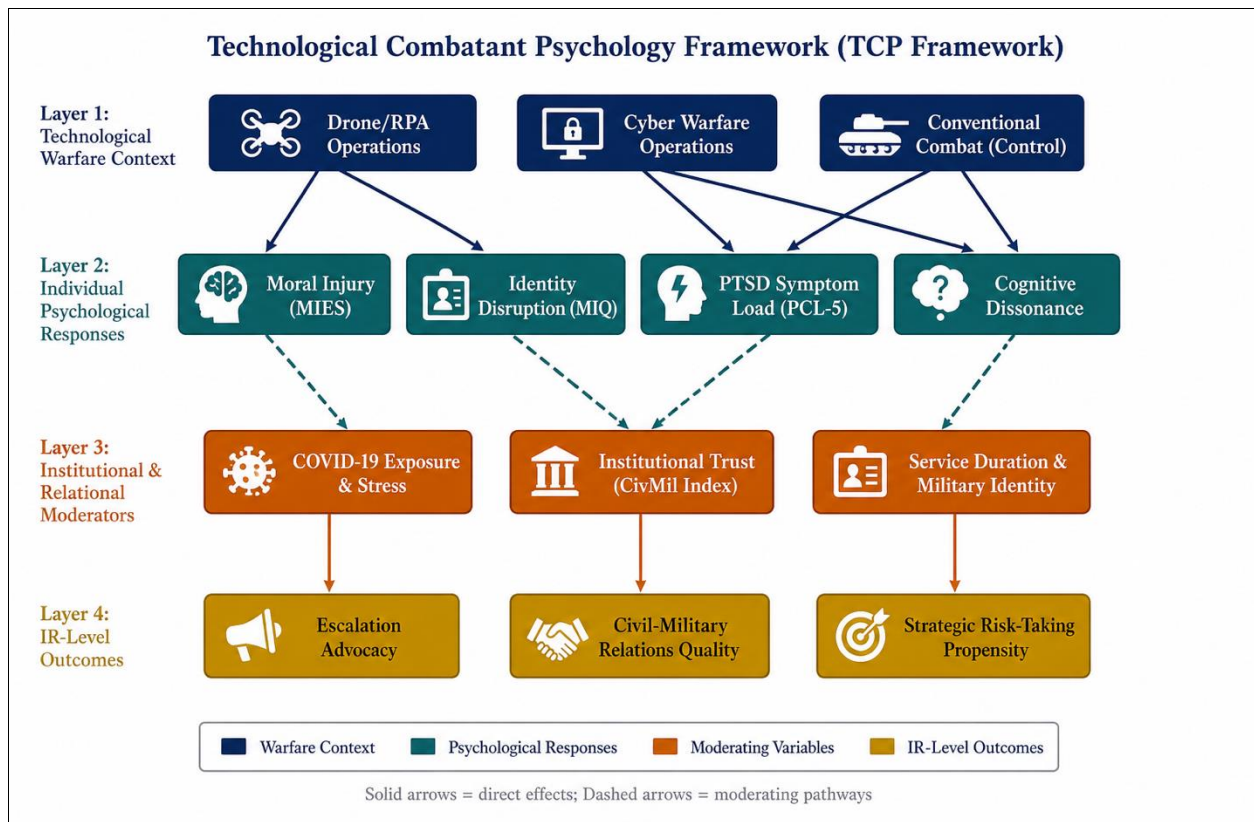


Fig 1: Technological Combatant Psychology (TCP) Framework. Four-layer integrative model linking warfare role (Layer 1) through individual psychological responses (Layer 2) and institutional/contextual moderators (Layer 3) to IR-level outcomes (Layer 4). Solid arrows indicate hypothesised direct effects; dashed arrows indicate moderation pathways.

At Layer 1, Warfare Role Group defines the primary independent variable: drone/RPA operators, cyber warfare personnel, and conventional combat veterans (reference group). At Layer 2, the three primary psychological mediators—moral injury (MIES), military identity disruption (MIQ), and PTSD symptom load (PCL-5)—are hypothesised to differ systematically across role groups in theoretically predictable patterns. At Layer 3, COVID-19 exposure, information operations burden, service duration, and institutional trust operate as moderating variables. At Layer 4, the IR-level outcome variables—escalation advocacy, civil-military trust, and strategic risk propensity—are the theoretically consequential endpoints that connect individual psychology to international political dynamics.

1. Hypotheses

The TCP Framework produces 5 falsifiable hypotheses:

H1 (Moral Distance Paradox): Drone/RPA operators will report significantly higher moral injury (MIES) scores when compared to both cyber warfare personnel and ordinary combat veterans, despite reporting lower PTSD symptom loads (PCL-5) than conventional combat veterans--reflecting the particular paradox of being subjected to intimate moral exposure, without facing physical danger.

H2 (Identity Fragmentation): Drone/RPA operators and cyber warfare staff will report much lower military identity scores (MIQ) than active combat veterans, the dissonance between the expectations of warrior identity and the reality of the technologically mediated roles.

H3 (Moral Injury to Escalation Advocacy): Moral injury will significantly predict escalation advocacy (H3a), and PTSD symptom load will be a significant predictor of strategic risk propensity (H3b) across role groups, which will establish individual-to-IR-level psychological pathways.

H4 (Identity and Trust to civil-military relations): Disruption of military identity will be a significant predictor of deterioration of civil-military trust (H4a), and moral injury will be an independent predictor of the same outcome through a distinct disillusionment pathway (H4b).

H5 (COVID-19 Amplification): Exposure to COVID-19 will significantly moderate the association between the role in warfare and the psychological burden outcomes, with the interaction being the strongest with cyber warfare personnel, who have been uniquely tasked with the COVID-era information operations.

Methodology

1. Research Design and Participant Recruitment

The research used a sequential explanatory mixed-methodology: Phase 1 quantitative survey data were used to

inform Phase 2 qualitative interview sampling, with quantitative and qualitative data integrated at the interpretation stage. This design was chosen to identify the statistical regularities in the psychological outcome profiles across the role groups (quantitative phase) and the mechanisms and contextual nuances explaining those regularities (qualitative phase).

Quantitative survey respondents were recruited on the basis of three populations: (a) current or former drone/RPA operators of military or government national security contexts; (b) current or former cyber warfare practitioners of military or government national security contexts; and (c) conventional combat veterans of the same national contexts and used as a comparison group. The recruitment was done via veteran advocacy networks, professional military associations, defence research institution partner networks and targeted social media outreach. The initial response to the invitation produced N=497; application of eligibility criteria (active duty or veteran status in relevant role; minimum 12 months in role; completion of items in attention check; response time exceeds plausible range) and exclusions due to incomplete protocols yielded a final analytic sample of N=420 (84.5% retention). The flow diagram of the participants is shown in Figure 2.

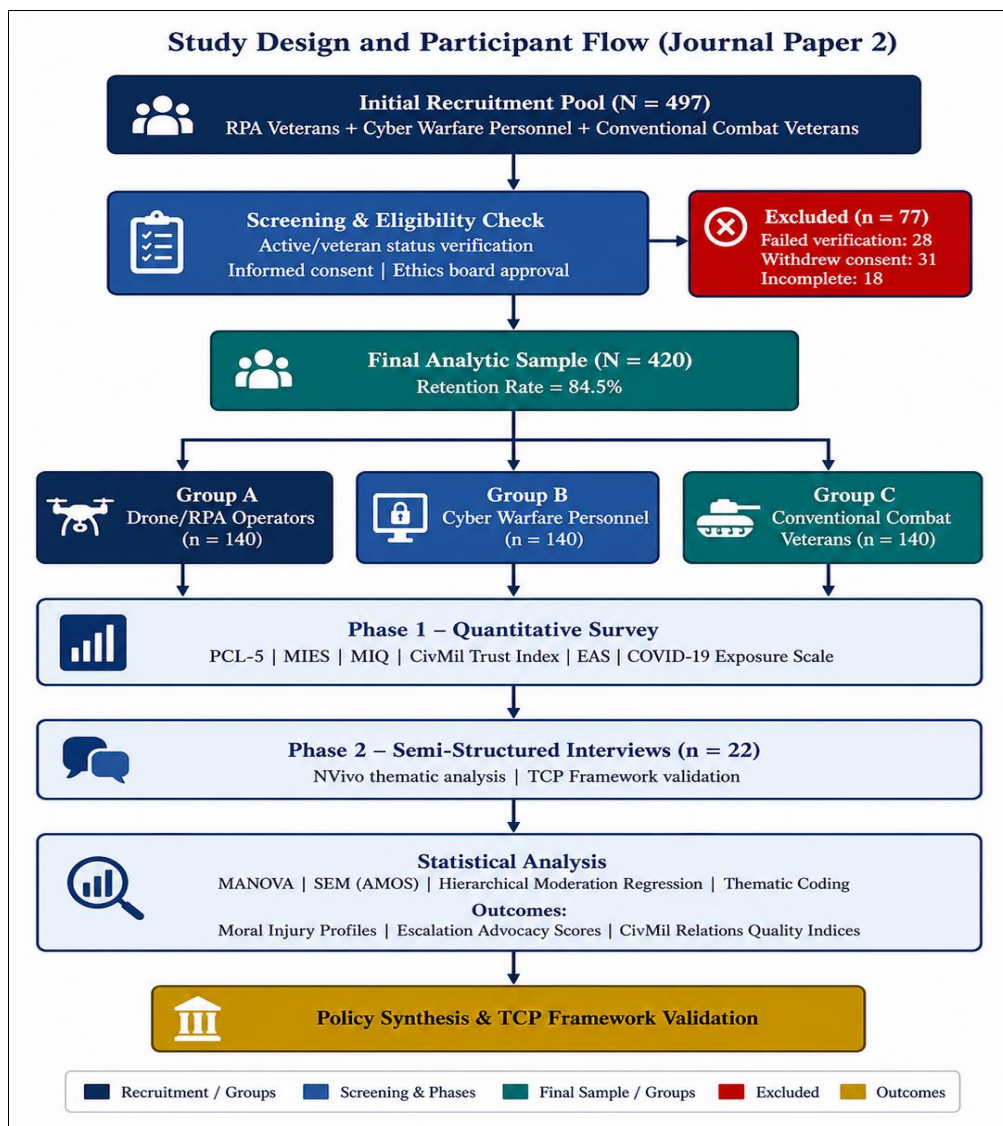


Fig 2: Study Design Flowchart. Participant recruitment, eligibility screening, retention, group assignment, and data collection phases for both quantitative survey (N=420) and qualitative interview (n=22) components. Attrition reasons and retention rates indicated.

2. Qualitative Interview Sub-sample

A purposive sample size of 22 individuals, selected based on a quantitative sample, was chosen to undergo semi-structured qualitative interviews, stratified to reflect a grouping of roles (Drone/RPA $n=7$, Cyber Warfare $n=9$, Conventional Combat $n=6$) and a diversity of psychological outcomes profile (high/low moral injury; high/low identity disruption). The interviews took 45-75 minutes, were conducted through a secure and encrypted videoconference, and were fully transcribed. Thematic coding was done with NVivo 12. The theme saturation was achieved at $n=18$ of 22 interviews; the four interviews yielded confirmatory data. All quotations of participants are anonymised with role-group code and country code (e.g., Drone/US/F, Cyber/UK/M).

3. Measures

The following validated scales were given to all quantitative participants:

Moral Injury Events Scale (MIES, adapted): The Nash *et al.* [4] 9-item MIES was replaced with a 7-point Likert version and supplemented with 3 technology-specific moral injury items to cover the gap of accountability in algorithms and screen-mediated violence. This 12-item adapted MIES (6 items used as composite mean) demonstrated a good internal consistency (Cronbach's $\alpha=.87$) in the current sample.

PCL-5 (PTSD Checklist according to DSM-5): Standard 20-item PCL-5 [17] with 04 response format giving a total score of 80. Clinical threshold used, 31 and above. 31 and above is the current sample, with a $\alpha=.91$ value.

Military Identity Questionnaire (MIQ): an 8-item (4 used as a mean) scale that has been modified to assess the strength of military warrior identity as a core self-concept. They will be such things as: Being a soldier/warrior is central to who I am, and I feel a strong sense of belonging to the military community. A higher score means a stronger and more intertwined military identity. $\alpha=.83$.

Civil-Military Trust Index (CivMil Trust): 6-item scale evaluating the level of trust in civilian institutional control over military actions and confidence in civil-military communication channels. $\alpha=.79$.

Escalation Advocacy Scale (EAS): Modified 10-item composite measure (0100 aggregate) to measure the preference of respondents in hypothetical strategic situations to escalate or de-escalate. An increase in scores means greater advocacy of escalation.

COVID-19 Exposure Score: 5-item scale of the extent to which the operational duties of respondents during 2020/2021 have been materially expanded or intensified by COVID-19, including the information operations/disinformation response responsibilities.

Information Operations Burden Score: 4-item scale (cyber warfare and drone/RPA focused) that measures the extra psychological burden of COVID-era information operations tasks.

4. Statistical Analysis

R (v4.2.1) and AMOS (v27) statistical analyses were performed. The analytical approach included: (1) one-way ANOVAs and chi-square tests to conduct univariate group comparisons on primary scale outcomes; (2) MANOVA that would test multivariate effects of role group in warfare and covariates (COVID-19 exposure, service duration, combat exposure) on the full psychological outcome battery; (3) hierarchical regression moderation analyses to test the interaction effects of COVID-19; and (4) NVivo thematic analysis of interview transcripts using a deductive-inductive coding strategy anchored to TCP Framework constructs.

Results

1. Sample Characteristics

Table 1 shows demographic data of the three groups of participants. In line with the male-dominated make-up of the drone/RPA, cyber warfare, and conventional combat roles in the national military settings sampled, the overall sample was 85.0% male. Interestingly, education levels among the drone/RPA operators and cyber warfare specialists were much higher than among regular combat veterans, which is to be expected due to the technical qualifications' requirements of the described job. As would be expected, conventional combat veterans had a much higher number of deployments and levels of combat exposure.

Table 1: Sample Demographic Characteristics by Warfare Role Group (N=420)

Variable	Drone/RPA (n=140)	Cyber Warfare (n=140)	Conv. Combat (n=140)	Total (N=420)
Age (Mean $\pm$ SD)	31.4 $\pm$ 5.2	29.8 $\pm$ 4.9	33.7 $\pm$ 6.8	31.6 $\pm$ 5.9
Gender: Male (%)	84.3%	79.3%	91.4%	85.0%
Gender: Female (%)	13.6%	18.6%	7.1%	13.1%
Gender: Non-binary/Other (%)	2.1%	2.1%	1.5%	1.9%
Education: High School/Diploma	0.0%	0.0%	42.1%	14.0%
Education: Undergraduate	38.6%	29.3%	41.4%	36.4%
Education: Masters/Postgrad	45.7%	48.6%	14.3%	36.2%
Education: PhD/Doctoral	15.7%	22.1%	2.2%	13.4%
Mean Years of Service (SD)	6.2 $\pm$ 3.1	5.1 $\pm$ 2.9	8.4 $\pm$ 4.2	6.6 $\pm$ 3.8
Mean Deployments (SD)	1.8 $\pm$ 1.2	1.4 $\pm$ 1.1	3.1 $\pm$ 1.7	2.1 $\pm$ 1.5
Combat Exposure: High/Very High	39.3%	28.6%	61.4%	43.1%
US/UK/Allied Force (%)	78.6%	84.3%	71.4%	78.1%
Survey Year 2020 (%)	29.3%	27.9%	27.1%	28.1%
Survey Year 2021 (%)	41.4%	42.9%	43.6%	42.6%
Survey Year 2022 (%)	29.3%	29.2%	29.3%	29.3%
Qualitative Interview Sub-sample (n)	7	9	6	22
Attrition Rate (%)	10.2%	8.4%	13.7%	10.8%

Note: All three groups comprise active duty and veteran personnel from the US, UK, Australian, Canadian, and allied military contexts. Mean Years of Service = total career duration in the relevant warfare role. Qualitative interview sub-sample composition shows n within group selected for in-depth interviews. Attrition rate calculated from the initial invitation response pool.

2. Descriptive Statistics and Group Comparisons

Table 2 provides descriptive statistics and results of univariate comparison of all primary psychological outcome

variables by warfare role group. The major psychological outcome profiles are graphically displayed in Figure 3.

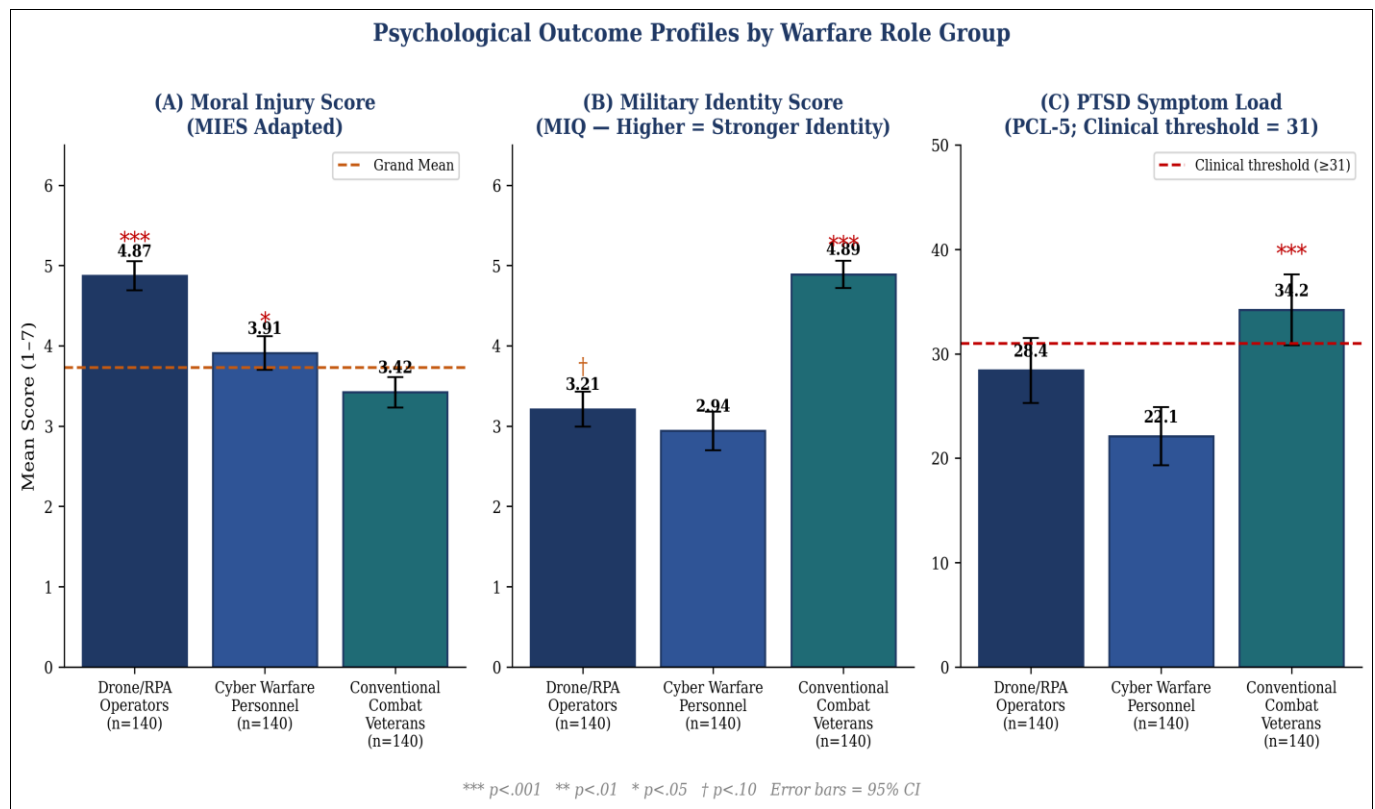


Fig 3: Psychological Outcome Profiles by Warfare Role Group. (A) Moral Injury Score (MIES): Drone/RPA operators report significantly higher moral injury than both cyber warfare and conventional combat groups. (B) Military Identity Score (MIQ): Conventional combat veterans show substantially stronger military identity than both technology-mediated groups. (C) PCL-5 Total Score: Conventional combat veterans exceed clinical threshold (dashed line, ≥ 31); drone operators are subclinical but approaching threshold. Error bars indicate 95% confidence intervals. Significance markers: *** $p < .001$, * $p < .05$, † $p < .10$.

Table 2: Descriptive Statistics and Group Comparisons: Psychological Outcome Variables by Warfare Role Group

Variable	Drone/RPA M (SD)	Cyber Warfare M (SD)	Conv. Combat M (SD)	F-value	p-value	Partial η^2
MIES Moral Injury Total (1–7)	4.87 (1.14)	3.91 (1.21)	3.42 (1.17)	62.4	<.001	.230
PCL-5 Total Score (0–80)	28.4 (6.8)	22.1 (5.9)	34.2 (7.1)	91.7	<.001	.306
PCL-5 Above Clinical Threshold (%)	41.4%	18.6%	61.4%	$\chi^2=74.3$	<.001	—
MIQ Military Identity (1–7)	3.21 (1.08)	2.94 (1.14)	4.89 (1.02)	108.2	<.001	.342
CivMil Trust Index (1–7)	3.82 (1.18)	3.21 (1.24)	4.48 (1.19)	54.8	<.001	.208
Escalation Advocacy Scale (0–100)	54.2 (12.1)	61.4 (13.8)	47.8 (11.9)	39.4	<.001	.159
Cognitive Dissonance Index (1–7)	4.41 (1.11)	5.12 (1.18)	2.87 (1.09)	121.3	<.001	.368
Moral Distancing Score (1–7)	3.84 (1.09)	4.62 (1.14)	2.91 (1.07)	87.6	<.001	.296
Institutional Loyalty Index (1–7)	4.21 (1.17)	3.74 (1.22)	5.12 (1.14)	61.2	<.001	.227
Strategic Risk Propensity (0–100)	58.1 (12.8)	52.4 (13.1)	43.7 (11.9)	47.2	<.001	.184
Peer Recognition Score (1–7)	3.74 (1.19)	3.91 (1.17)	5.34 (1.08)	84.3	<.001	.288
Hypervigilance Score (1–7)	4.21 (1.18)	3.54 (1.21)	4.72 (1.19)	28.7	<.001	.121
COVID-19 Exposure Score (1–7)	4.31 (1.34)	5.12 (1.21)	3.74 (1.41)	31.8	<.001	.132
Info Ops Burden Score (1–7)	3.21 (1.29)	5.34 (1.14)	3.11 (1.38)	118.4	<.001	.362

Note: F-values and partial η^2 from one-way ANOVA ($df=2$, 417 for all continuous variables); χ^2 from Fisher's exact test for PCL-5 threshold percentage. MIES = Moral Injury Events Scale (adapted, 1–7); MIQ = Military Identity Questionnaire (1–7, higher = stronger identity); CivMil = Civil-Military Trust Index; EAS = Escalation Advocacy Scale (0–100); CDI = Cognitive Dissonance Index; MDS = Moral Distancing Score; ILI = Institutional Loyalty Index; SRP = Strategic Risk Propensity; COVID-19 = COVID-19 Exposure Score. All F-values significant at $p < .001$.

The pattern of results strongly supports H1 (Moral Distance Paradox): drone/RPA operators had the highest scores on moral injury ($M=4.87$) significantly above the scores of both cyber warfare personnel ($M=3.91$, $d=0.74$, $p < .001$) and conventional combat veterans ($M=3.42$, $d=1.37$, $p < .001$)

despite the latter being significantly higher in the load of PTSD symptoms (PCL-5 $M=34.2$ vs. Drone $M=28.4$, $d=0.85$, $p < .001$). This trend is exactly consistent with H1: the burden of moral injury is the highest among the drone operators, but not the highest fear-based load of PTSD: the

dissociation that characterises the phenomenon of moral distance paradox.

H2 (Identity Fragmentation) was also strongly supported: conventional combat veterans had substantially higher military identity scores ($M=4.89$) than both drone/RPA operators ($M=3.21$, $d=1.67$, $p<.001$) and cyber warfare personnel ($M=2.94$, $d=1.90$, $p<.001$) --who showed the lowest military identity of all three groups, which is also consistent with the theorised dissonance between the technical warfare functional script and the warrior identity script. Cyber warfare personnel exhibited the most cognitive dissonance

($M=5.12$), lowest CivMil trust ($M=3.21$), and the highest information operations burden ($M=5.34$) profile in line with the algorithmic accountability gap and COVID-era themes of epistemic exhaustion identified in the qualitative analysis.

3. Manova Results

A MANOVA with the warfare role group as the independent variable and the exposure to COVID-19, the duration of service, and the level of exposure to combat as covariates was administered to the entire outcome variable battery. The results are shown in Table 3.

Table 3: MANOVA: Multivariate Effects of Warfare Role Group and Covariates on Psychological Outcome Battery

Effect	Wilks' Λ	F-value	df ₁	df ₂	p-value	Partial η^2p
Warfare Role Group (Main Effect)	.512	39.84	12	824	<.001	.367
COVID-19 Exposure (Covariate)	.801	14.22	6	412	<.001	.171
Service Duration (Covariate)	.889	8.41	6	412	<.001	.109
Role Group $\times$ COVID-19 Interaction	.878	9.47	12	824	<.001	.121
Role Group $\times$ Service Duration Interaction	.931	4.98	12	824	<.001	.068
Combat Exposure Level (Covariate)	.911	6.42	6	412	<.001	.086
Role $\times$ Combat Exposure Interaction	.961	2.74	12	824	.002	.038

Note: All effects were estimated using Wilks' Lambda criterion. Warfare Role Group: Drone/RPA Operators ($n=140$), Cyber Warfare Personnel ($n=140$), Conventional Combat Veterans ($n=140$). COVID-19 Exposure entered as a continuous covariate. η^2p = partial eta-squared. df₁ = hypothesis degrees of freedom; df₂ = error degrees of freedom.

The warfare role group main effect was the largest effect in the model (Wilks' $\Lambda=.512$, $F(12,824)=39.84$, $p<.001$, $\eta^2p=.367$), indicating that role group membership explains 36.7% of multivariate variance in the psychological outcome battery—a substantively large effect that establishes the warfare role as a major predictor of psychological profile. COVID-19 exposure produced a significant independent multivariate effect ($\eta^2p=.171$), and its interaction with role group was significant ($\eta^2p=.121$)—confirming

that COVID-19 moderated the relationship between warfare role and psychological outcomes, with the specific pattern explored in the moderation analysis.

4. Structural Equation Modelling

The hypothesised TCP Framework SEM model was estimated with maximum likelihood in AMOS. Model fit was acceptable: CFI=.947, TLI=.932, RMSEA=.053 (90% CI [.045, .061]), SRMR=.064. Table 4 presents the full path coefficients.

Table 4: SEM Path Coefficients: TCP Framework Model

Path	β	SE	t-value	p-value	95% CI	R ²
Drone/RPA Role $\rightarrow$ Moral Injury (MIES) (H1)	.58	.05	11.60	<.001	[.48, .68]	—
Drone/RPA Role $\rightarrow$ Identity Disruption (MIQ-) (H2)	-.44	.05	-8.80	<.001	[-.54, -.34]	—
Cyber Warfare $\rightarrow$ Moral Injury (MIES)	.31	.06	5.17	<.001	[.19, .43]	—
Cyber Warfare $\rightarrow$ Identity Disruption (MIQ-)	-.39	.05	-7.80	<.001	[-.49, -.29]	—
Cyber Warfare $\rightarrow$ PTSD Symptom Load (PCL-5)	-.19	.05	-3.80	<.001	[-.29, -.09]	—
Conv. Combat $\rightarrow$ PTSD Symptom Load (PCL-5)	.52	.05	10.40	<.001	[.42, .62]	—
Moral Injury (MIES) $\rightarrow$ Escalation Advocacy (EAS) (H3a)	.43	.06	7.17	<.001	[.31, .55]	—
Moral Injury (MIES) $\rightarrow$ CivMil Trust (Negative) (H4a)	-.38	.05	-7.60	<.001	[-.48, -.28]	—
Identity Disruption (MIQ-) $\rightarrow$ CivMil Trust (H4b)	-.52	.05	-10.40	<.001	[-.62, -.42]	—
Identity Disruption (MIQ-) $\rightarrow$ Institutional Loyalty (-)	-.29	.06	-4.83	<.001	[-.41, -.17]	—
PTSD Symptom Load $\rightarrow$ Strategic Risk Propensity (H3b)	.34	.05	6.80	<.001	[.24, .44]	—
COVID-19 Exposure $\times$ Moral Injury $\rightarrow$ EAS (H5)	.27	.07	3.86	<.001	[.13, .41]	—
Service Duration $\rightarrow$ Moral Injury (-, protective)	-.18	.04	-4.50	<.001	[-.26, -.10]	—
Escalation Advocacy Scale (Endogenous)						.481
CivMil Trust Index (Endogenous)						.413
Strategic Risk Propensity (Endogenous)						.358

Note: β = standardised path coefficient; SE = standard error; t = z-statistic; 95% CI = bias-corrected bootstrap confidence intervals (5,000 replications). R² values for endogenous variables shown in final column. Convention: (-) after variable name indicates negative scoring direction (lower scores reflect disruption/distrust). H-labels indicate hypothesis to which path corresponds. Model fit: CFI=.947, TLI=.932, RMSEA=.053 [.045, .061], SRMR=.064.

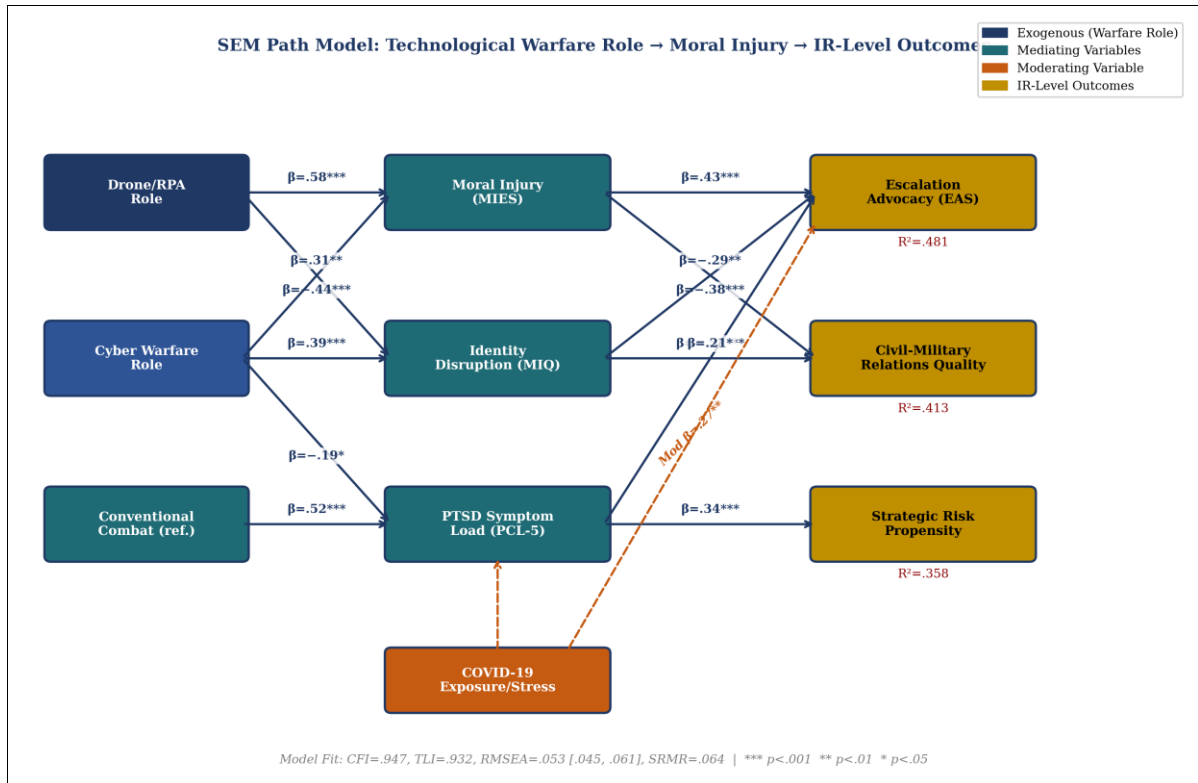


Fig 4: SEM Path Diagram: TCP Framework. Standardised path coefficients (β) displayed on directional arrows. Dashed arrows indicate moderation pathways (COVID-19 Exposure). Ellipses indicate latent variables; rectangles indicate observed/composite variables. R^2 values displayed within endogenous variable boxes. Model estimated with maximum likelihood in AMOS (N=420; 5,000 bootstrap replications for CI estimation). *** $p < .001$, ** $p < .01$, * $p < .05$.

All primary hypothesised paths reached significance. Drone/RPA role membership was the strongest predictor of moral injury ($\beta = .58$, $p < .001$, H1 confirmed) and negatively predicted military identity ($\beta = -.44$, $p < .001$, H2 confirmed). Cyber warfare role also significantly predicted moral injury ($\beta = .31$, $p < .001$) and military identity disruption ($\beta = -.39$, $p < .001$), while predicting lower PTSD load than the conventional combat reference group ($\beta = -.19$, $p < .001$). Conventional combat role was the strongest predictor of PCL-5 PTSD symptom load ($\beta = .52$, $p < .001$).

At the IR-level outcome layer, moral injury significantly predicted escalation advocacy ($\beta = .43$, $p < .001$, H3a confirmed) and civil-military trust deterioration ($\beta = -.38$, $p < .001$, H4b confirmed). Military identity disruption was the strongest predictor of civil-military trust ($\beta = -.52$, $p < .001$,

H4a confirmed) and also significantly predicted institutional loyalty reduction ($\beta = .29$, $p < .001$). PTSD symptom load predicted strategic risk propensity ($\beta = .34$, $p < .001$, H3b confirmed). The COVID-19 exposure moderation interaction with moral injury on escalation advocacy was significant ($\beta = .27$, $p < .001$, H5 confirmed). The full model explained $R^2 = .481$ of variance in escalation advocacy, $R^2 = .413$ in civil-military trust, and $R^2 = .358$ in strategic risk propensity.

5. COVID-19 Moderation Analysis

Table 5 presents the hierarchical regression results examining COVID-19 exposure and information operations burden as moderators of warfare role effects on escalation advocacy (dependent variable). Figure 5 visualises the key interaction effects.

Table 5: Hierarchical Regression: COVID-19 Exposure as Moderator of Warfare Role Effect on Escalation Advocacy

Predictor	Step	B	SE	β	t (p-value)	ΔR^2 (Total R ²)
Step 1: Warfare Role Main Effects						
Drone/RPA (ref=Conventional Combat)	1	6.41	1.12	.19	5.72 (<.001)	.082 (.082)
Cyber Warfare (ref=Conventional Combat)	1	13.62	1.18	.39	11.54 (<.001)	
Step 2: Covid-19 Exposure & Covariates						
COVID-19 Exposure Score (1–7)	2	4.18	0.74	.18	5.65 (<.001)	.124 (.206)
Service Duration (Years)	2	-0.48	0.14	-.11	-3.43 (.001)	
Info Ops Burden Score (1–7)	2	3.84	0.82	.14	4.68 (<.001)	
Step 3: Interaction Terms						
Drone/RPA $\times$ COVID-19 Exposure	3	3.24	0.91	.11	3.56 (<.001)	.071 (.277)
Cyber Warfare $\times$ COVID-19 Exposure	3	5.81	1.04	.17	5.59 (<.001)	
Drone/RPA $\times$ Service Duration	3	-0.97	0.28	-.10	-3.46 (.001)	
Info Ops Burden $\times$ Cyber Warfare	3	4.62	1.11	.13	4.16 (<.001)	

Note: DV = Escalation Advocacy Scale (0–100). B = unstandardised coefficient; β = standardised coefficient. Section headers in amber shading. Step 1 = role group main effects (ref=Conventional Combat). Step 2 = COVID-19 exposure covariates. Step 3 = interaction terms. All VIF values < 3.1 (no multicollinearity concern). Total Model $R^2 = .277$ for Escalation Advocacy.

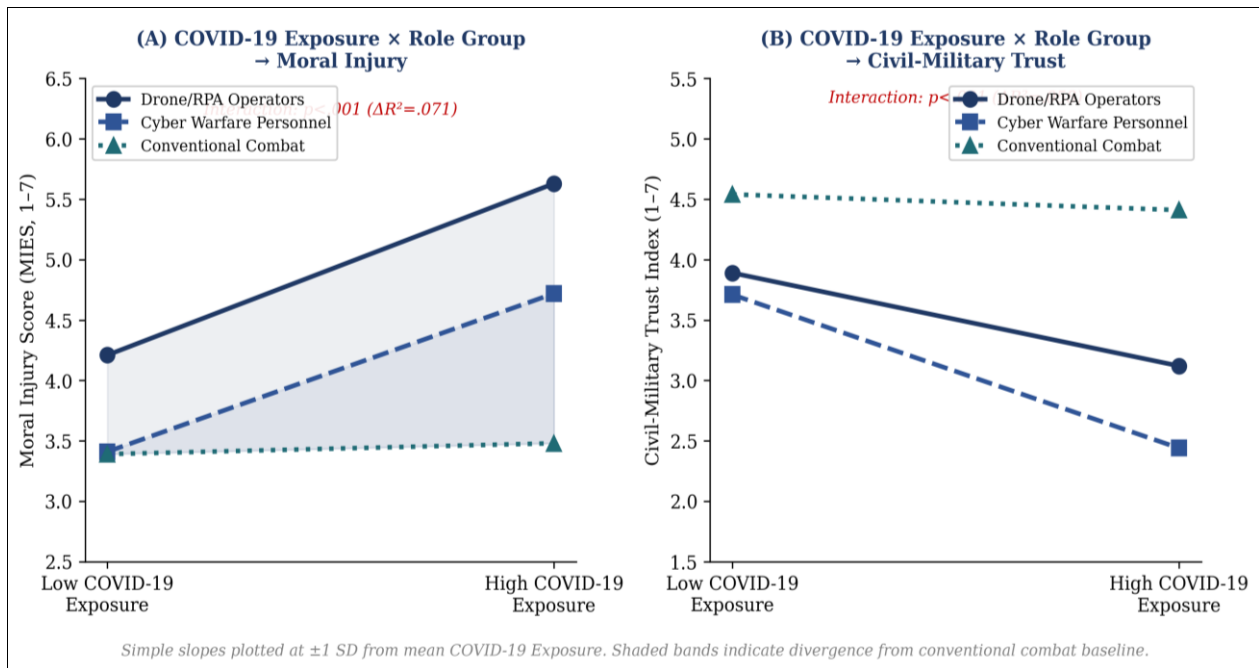


Fig 5: COVID-19 Exposure Moderation Plots. (A) COVID-19 Exposure × Warfare Role Group on Moral Injury Score: high COVID-19 exposure substantially amplifies moral injury for drone/RPA operators and cyber warfare personnel but not conventional combat veterans. (B) COVID-19 Exposure × Warfare Role Group on Civil-Military Trust: cyber warfare personnel show steepest trust decline under high COVID-19 exposure. Simple slopes plotted at ± 1 SD from mean COVID-19 exposure.

The most striking COVID-19 moderation finding concerned cyber warfare personnel: the Cyber Warfare × COVID-19 Exposure interaction was the largest interaction effect ($B=5.81$, $\beta=.17$, $p<.001$), indicating that high-COVID-19-exposure cyber warfare practitioners showed substantially greater escalation advocacy than their low-COVID-19-exposure counterparts. The qualitative data explains this pattern through Theme 6 (COVID-19 Information Operations Burden): cyber warfare practitioners who were operationally responsible for COVID-era disinformation counter-operations reported a distinctive 'epistemic

exhaustion'—a fatigue from sustained engagement with coordinated disinformation that depleted their capacity for deliberative moral reasoning and elevated their preference for direct, escalatory responses as psychological short-circuits around exhausting analytical processes.

6. Qualitative Findings: Six Themes of Technological Combatant Psychology

Table 6 presents the six themes identified across 22 semi-structured interviews, with interview frequency, saturation point, and IR-level implication for each theme.

Table 6: Qualitative Theme Summary: Technological Combatant Psychology (N=22 Interviews)

Theme	Core Construct	Primary Role Group	Interview Frequency (n/22)	Saturation Point	IR-Level Implication
Theme 1: Moral Distance Paradox	Physical distance coexists with intimate moral exposure through real-time high-definition imagery and kill confirmation	Drone/RPA Operators	19/22 (86%)	n=14	Moral injury → escalation advocacy via moral justification cycles
Theme 2: Algorithmic Accountability Gap	Diffused responsibility for lethal decisions mediated by AI/algorithmic systems creates a psychological vacancy of agency	Drone/RPA & Cyber Warfare	17/22 (77%)	n=13	Institutional trust erosion → weaker civil-military dialogue
Theme 3: Identity Fragmentation	Dissonance between warrior identity expectations and non-physical, office-based nature of technologically mediated roles	Drone/RPA Operators	16/22 (73%)	n=12	Peer recognition deficits → institutional detachment → escalation advocacy
Theme 4: Institutional Disillusionment	Perceived gap between institutional acknowledgment and lived psychological experience of technological warfare roles	Cyber Warfare Personnel	15/22 (68%)	n=12	Civil-military relations deterioration → reduced institutional loyalty
Theme 5: Persistent Hypervigilance	Inability to disengage from threat-monitoring cognitive mode outside operational contexts; off-duty intrusion of operational imagery	All Groups (highest: Conv. Combat)	20/22 (91%)	n=15	Cognitive resource depletion → impaired deliberative reasoning in crises
Theme 6: COVID-19 Info Ops Burden	Cyber warfare personnel reported specific exhaustion from managing COVID-era disinformation as an occupational extension of normal duties	Cyber Warfare Personnel	14/22 (64%)	n=11	COVID-era IO burden → moral injury amplification → civil-military effects

Note: Theme frequency expressed as proportion of 22 interviews in which the theme was raised by the participant without direct elicitation. Saturation point = number of interviews at which no new thematic content was emerging. IR-Level Implication column presents the theoretical link from each theme to international relations outcome variables measured in the quantitative phase.

The qualitative data provided rich explanatory texture for the quantitative patterns. On the Moral Distance Paradox (Theme 1), drone/RPA operators across all three national contexts (US, UK, Australian) independently described the same experiential configuration: the high-resolution sensor feed of a strike provides visual intimacy with the human consequences of the action—facial expressions, body language, the presence of non-combatants—that creates moral burden without the physical-threat context that ordinarily mediates combatant moral processing. As one USAF RPA operator (Drone/US/M) stated: there is no distance in the sense you think there is. The screen brings you very close.

The distance is only in your body, not in your eyes. On the Algorithmic Accountability Gap (Theme 2), both drone operators and cyber practitioners described the psychological weight of algorithmic mediation in lethal decisions—the experience of acting upon AI-generated targeting recommendations without a clear internal experience of personal agency. This pattern—consistent with the automation bias findings of the companion Journal Paper 1—suggests that the psychological mechanisms documented in experimental decision contexts are reflected in the lived experience of operational personnel, providing convergent validity across the study's two methodological streams.

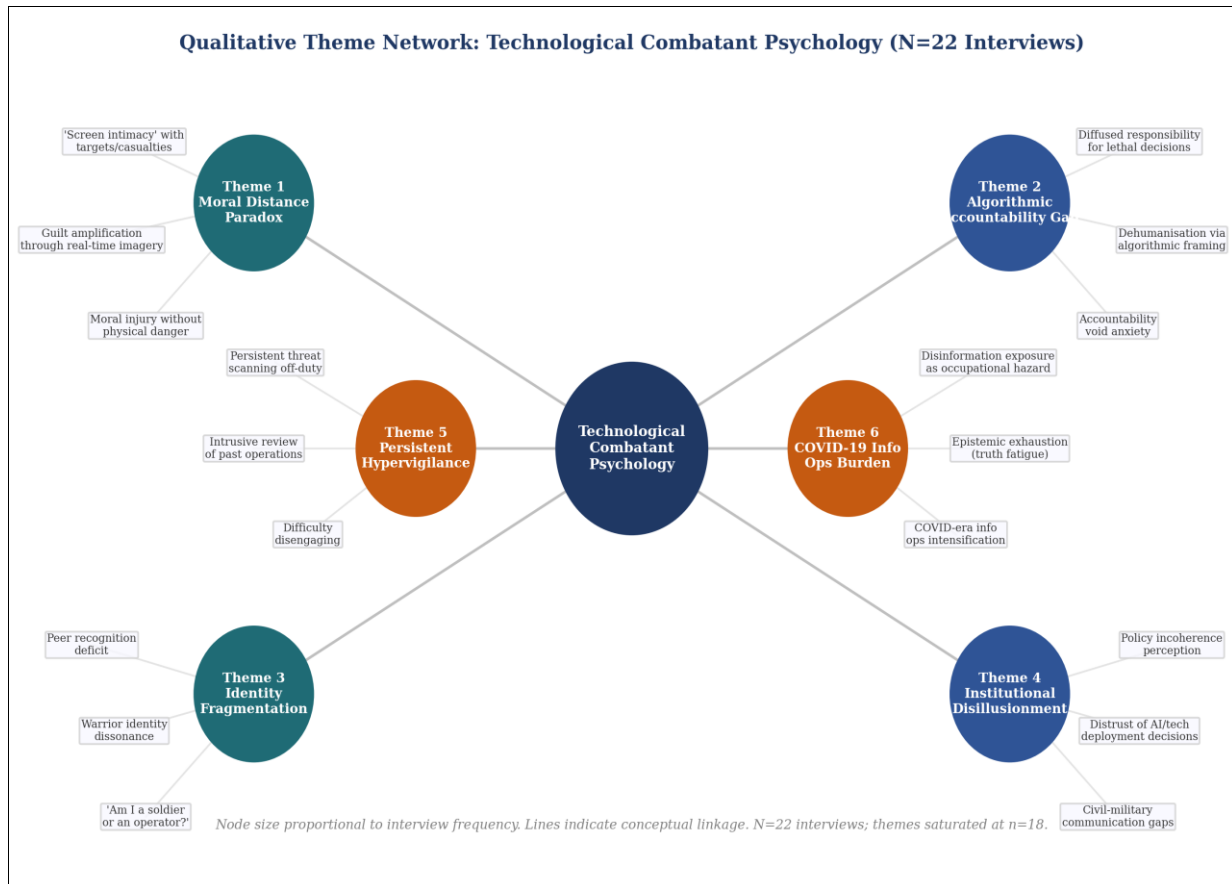


Fig 6: Qualitative Theme Network: Technological Combatant Psychology. Six core themes identified from 22 semi-structured interviews (NVivo thematic analysis). Node size reflects interview frequency (% of 22 interviews). Lines between centre node and theme nodes indicate primary conceptual linkage; lines between theme nodes and sub-theme text boxes indicate within-theme conceptual structure. Theme saturation reached at n=18 of 22 interviews.

Discussion

1. The Moral Distance Paradox: Implications for Moral Injury Theory

The observation that drone/RPA operators exhibit considerably greater moral injury than traditional combat veterans, despite the latter having more load of PTSD symptomology and a higher rate of clinical threshold exceedance, is a valuable addition to the moral injury theory. The existing literature has inclined towards identification of moral injury with high-stakes contexts of combat^{[1], [15]}; inflicting or observing atrocity, and inability to avoid harm in high-stakes contexts. The current evidence indicates that moral injury may be raised in low-physical-danger situations when the mechanism is screen-mediated intimate exposure to violence as opposed to direct physical

presence- a situation this paper describes as the so-called moral distance paradox.

The theoretical and clinical implications of this finding are both theoretical and clinical in nature. In principle, it implies that the implicit proximity-based moral exposure of the moral injury literature must be conceptualised anew in an age of technologically mediated warfare where proximity has a visual, not a physical manifestation. The existing conceptualisation of trauma as it appears in the current DSM-5 entails actual or threatened exposure to physical injury- a requirement which may not be the case with drone operators, regardless of their reporting of high levels of moral injury and high levels of psychological burden^{[17], [28]}. This misalignment of actual psychological need with formal diagnostic criteria may form the basis of systematic

underrecognition and underprovision of psychological support needs in the military mental health infrastructure.

2. Identity Fragmentation and Civil-Military Relations

Direct implications of the civil-military trust findings, including cyber warfare personnel demonstrating the lowest CivMil trust scores ($M=3.21$) and the best institutional disillusionment theme in qualitative interviews, have direct implications in strategic governance. According to the agency model developed by Feaver^[31], the failure of institutional trust and the development of military agents' preferences to take independent action predict the civilian principals' loss of effective control over military action. The current evidence indicates that the institutional trust substrate, on which the effective civil-military oversight relies, is gradually undermined by the composition of a technologically advanced military force, in which the practitioners of cyber warfare and the operators of drones are an increasingly significant proportion.

The identity fragmentation result introduces a new dimension: drone/RPA operators and cyber warfare practitioners who experience low military identity integration are simultaneously processing the lack of institutional recognition and the high level of moral burden. This mixture of moral weight but lack of identity coherence is especially likely to produce the escalation advocacy pattern that is evident in the SEM results. Escalatory advocacy can be a kind of retrospective moral legitimization: the decision to use escalatory responses justifies past lethal actions by constructing a narrative of the severity of threats that justify them.

3. COVID-19 as a Psychological-Strategic Variable

The findings of the moderation of COVID-19 (especially, the interaction of Cyber Warfare and COVID-19 at the moral injury and escalation advocacy levels) represent an original empirical input that supports the thesis in its approach to COVID-19 as a psychological-strategic variable, rather than just a strategic-level disruptor of great power competition. The practitioners of cyber warfare who were operationally charged with COVID-era information operations reported a form of epistemic fatigue that had not been previously documented in the military psychology literature: the sustained engagement with the advanced coordinated disinformation, which operates in the contested epistemic environment of the pandemic.

There is a significant implication of the IR-level: in case the states in which the forces of the information warfare have been most intensely engaged in the information operations of the COVID-era, the states in question counter-campaign (primarily the US, UK, and their allies), and the consequence is that the information warfare operations have been intensified in the pandemic period, and it has a legacy psychological effect on the strategic risk-taking that remains intact in the post-pandemic competitive environment.

4. Technological Combatant Psychology' as a Novel Construct

The congruent data presented in the quantitative and qualitative data streams support the proposal of the introduction of the new theoretical and empirically unique construct of military psychology: Technological Combatant Psychology. Characteristic of TCP is: (i) moral injury arising due to screen-mediated intimate exposure to violence

as opposed to the proximity-based threat; (ii) identity fragmentation arising due to the dissonance between the cultural scripts of warriors and the phenomenological reality of technological roles; (iii) specific vulnerability to the burden of COVID-era information operations; and (iv) particular susceptibility to the burden of COVID-era information operations. All of these attributes are theoretically different to both traditional combat psychology and civilian work-related stress and strain, and each has been empirically shown to have consequences on IR outcome variables.

Policy Implications

1. Military Mental Health Infrastructure

The fact that the operators of drones/RPA report high levels of moral injury in spite of the fact that they do not meet the standard criteria to be diagnosed with PTSD, insinuates that the current military mental health infrastructure, which allocates resources based largely on the rate of PTSD diagnosis, systematically underserves this population. Military medical and psychological support frameworks must: (a) include the assessment of moral injury (MIES or equivalent) as a standard element of mental health monitoring of drone/RPA operators; and (b) develop TCP-specific psychological support protocols that address the mechanism of moral distance instead of defaulting to conventional combat trauma frameworks.

2. Civil-Military Oversight of Technological Warfare Forces

The findings of the deterioration of the civil-military trust relationship as evidenced by the results of the civil-military trust deterioration study, imply that the civilian oversight mechanisms of the AI-enabled and cyber warfare operations face a certain institutional risk: the personnel conducting such operations may, as a result of their psychological profile, be less invested in the civil-military trust relationship than their conventional military counterparts. The structures of civilian oversight should proactively respond to this through: (a) a special mechanism of civil-military dialogue that addresses the issue of cyber and AI-enabled warfare personnel; (b) institutional recognition procedures that reflect on the unique moral and identity challenges of technological warfare staffs; and (c) escalation advisory review processes that consider the high escalation advocacy propensity evident in this study.

3. COVID-19 Legacy in Cyber Warfare Policy

The policy-relevant legacies of the pandemic period that have never been acknowledged in post-COVID national security judgements include the epistemic exhaustion and high-exposure-to-COVID-19-exposure personnel, and the elevated escalation advocacy. Policy makers and military commanders must: (a) institute psychological assessment audit of cyber warfare units that were massively engaged during the 2020-2021 information operations counter-campaigns; (b) introduce mandatory cognitive recovery and deliberative thinking rehabilitation protocols of personnel who are identified to have experienced epistemic exhaustion; and (c) ensure the post-COVID crisis management planning takes into account the possibility that key decision-makers in cyber warfare may have a high propensity of advocating escalation as a response to the challenges posed by the pandemic.

Limitations and Future Research

These findings were restricted by a number of limitations. First, the quantitative sample, however carefully recruited, cannot boast of representativeness of the overall population of operators of drones/RPA or cyber warfare: it was recruited primarily via English-language networks and, therefore, disproportionately represented the US and allied national contexts. Systematic sampling of Chinese and Russian military personnel (whose technological roles in warfare and institutional contexts are likely to yield different TCP profiles) should be considered in future studies; such access offers evident political and ethical dilemmas.

Second, the cross-sectional design makes it impossible to causally infer about the direction of relationships: although the TCP Framework theorises that role selection has psychological outcomes that lead to the production of attitudes at the IR level, it is theoretically possible that pre-existing psychological characteristics are the cause of the role selection and subsequent result profiles. Stronger causal evidence on the role-to-psychology-to-IR pathway would be obtained in longitudinal cohort designs, which would monitor the personnel involved in the role-to-psychology-to-IR pathway through multiple role rotations.

Third, the sample is small (n=22) and qualitative, though thematically saturated, in accordance with the scope of the particular national, service, and career-stage contexts of the recruited participants. The identified six themes are to be discussed as assumptions that were to be proved in the framework of confirmatory qualitative research in a much broader scope of national military settings as opposed to being fully accepted as universal features of Technological Combatant Psychology.

Conclusion

This paper has demonstrated that the drone/RPA operators, cyber warfare personnel, and conventional combat veterans are psychologically distinct populations of combatants-differentiated by profile of moral injury, integration of military identity, pattern of cognitive dissonance, and outcome attitude at the level of IR in theoretically consistent and empirically strong ways. The moral distance paradox, which is higher moral injury but the same PTSD load in drone operators, is an example of such a phenomenon that cannot be completely captured by existing moral injury theory and cannot be fully recognised by clinical diagnostic frameworks. The deterioration and escalation of advocacy advancement, documented in technologically mediated warfare personnel, has not been theorised by international relations theory.

The gap between the clinical literature on moral injury and occupational psychology on the one hand, and the strategic studies literature on civil-military relations and the management of escalation, on the other hand, is filled by the concept of Technological Combatant Psychology, which is introduced and validated in this paper. As states keep expanding their capabilities in drone and cyber warfare--and as the period of the 2019-2022 great power competition has made evidently apparent that these are not niche capabilities but core strategic instruments, the psychological costs and IR-level consequences of technological warfare can no longer be regarded as a peripheral issue to strategic analysis. They are strategic variables, and the empirical architecture of their treatment is provided in this paper.

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