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Title: An experimental investigation into cardiovascular, haemodynamic and salivary alpha amylase reactivity to acute stress in Type D individuals.

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Abstract: Type D personality is characterised by increased social inhibition and negative affectivity. Research demonstrates associations between Type D and poor physical health. Maladaptive sympathetic arousal is suggested as a potential mechanism, however, findings are inconsistent and studies mainly focus on basic cardiovascular parameters. The current study examines cardiovascular and haemodynamic parameters in addition to salivary alpha amylase (sAA) as markers of sympathetic stress reactivity in Type D individuals. Healthy adults (N=75; 33 Type D; age 18-42; 64% female) completed a multitasking stressor while continuous beat-to-beat cardiovascular function was measured. Saliva samples were obtained at baseline, pre-task, post-task, +10minutes and +20minutes post-task. Type Ds exhibited dysfunctional cardiovascular reactivity, characterised by blunted total peripheral resistance, slower stroke volume recovery and potentially unhealthy changes in haemodynamic profile. Alpha amylase reactivity was evident, but group differences were not significant. Findings indicate dysregulated sympathetic reactivity in Type D individuals, exemplified by a maladaptive haemodynamic profile.

Keywords: Type D personality, stress reactivity, sympathetic arousal, haemodynamic profile, salivary alpha amylase, C-reactive protein.

Lay summary: Individuals who are naturally quite anxious or distressed but are also socially inhibited are referred to as having Type D personality. These individuals are deemed at higher risk of negative health outcomes, particularly in terms of their cardiac health. This study demonstrates that this could be because aspects of their cardiovascular system may respond in an abnormal way to stress.

Introduction

Type D personality is characterised by high levels of social inhibition (SI) and negative affectivity (NA) (Denollet, et al., 1996). Research has demonstrated associations between Type D and negative health outcomes in cardiac (e.g. Schiffer et al., 2005) and other clinical populations (Mols & Denollet, 2010a); and more recently in the general population (Smith et al., 2018). Type D is related to increased physical symptoms and poorer perceived health (Allen, Wetherell & Smith, 2019; Smith et al., 2018; Stevenson & Williams, 2014; Williams & Wingate, 2012), in addition to anxiety, depression, somatisation (Michal, Wiltink, Grande, Beutel & Brähler, 2011); maladaptive stress reactivity (e.g. Habra et al., 2003; Howard & Hughes, 2013; Kelly-Hughes, Wetherell & Smith, 2014); and poor coping, social support and health behaviours (Williams & Wingate, 2012; Booth & Williams, 2015). It is suggested that these factors may mediate the relationship between Type D personality and physical health.

Maladaptive sympathetic activity has been associated with heightened psychological distress and poor health (Carney, Freedland & Veith, 2005; Mancia, et al., 2007). In particular, exaggerated cardiovascular reactivity is linked to cardiovascular disease (Blascovich & Katkin, 1993), hypertension, atherosclerosis (Kamarck et al., 1997), and increased cardiac morbidity (Carney, Freedland & Veith, 2005). As such Type D is theorised as a prognostic risk factor for poor cardiac health (Denollet et al., 2006; Pedersen & Denollet, 2004) and sympathetic arousal is proposed as a pathway underpinning this link (Kupper, Pelle & Denollet, 2013).

Type D has been associated with dysregulated cardiovascular reactivity; however, findings are inconsistent. Habra et al., (2003) found negative affect to be linked to heightened blood pressure reactivity to a stressor in men, whereas, high social inhibition was associated with reduced heart rate. Further, Bibbey et al., (2015) observed greater cardiovascular reactivity in Type D individuals, but only in the presence of socially evaluative threat. Type D has also been associated with a lack of cardiovascular adaptation to a stressor (Howard & Hughes, 2013). By contrast, 'blunted' cardiovascular reactivity has also been observed in relation to Type D (Howard, Hughes, & James,

2011; Kelly-Hughes et al., 2014; O'Leary et al., 2013). This evidence suggests a complex relationship between Type D and cardiovascular reactivity. However, these studies have focused on only a selection of sympathetic measures, mainly basic cardiovascular parameters which may be underpinned by variations in more complex haemodynamic parameters including haemodynamic profile (see Gregg, James, Matyas & Thorsteinsson, 1999). As such, examination of these may be necessary to gain a clearer picture of sympathetic reactivity in Type D individuals.

With respect to other haemodynamic parameters, Williams, O'Carroll, and O'Connor, (2009) showed Type D was related to increased cardiac output (CO) in response to stress in males. Whereas, Howard et al., (2011) found that a group of Type D females exhibited a myocardial haemodynamic profile in response to a stressor. Type Ds have also shown an increase in vascular responding (O 'Leary et al., 2013) and exaggerated haemodynamic responses to a cold pressor task (Kupper, Pelle, and Denollet, 2013).

The majority of previous studies in this area have relied upon cardiovascular markers. However, levels of alpha amylase found in saliva has been suggested as a reliable biomarker of sympathetic nervous system activity (Nater et al., 2007; Nater & Rohleder, 2009). Increased salivary alpha amylase levels have been observed in response to a range of stressors (Nater et al., 2005; van Stegeren, Rohleder, Everaerd, & Wolf, 2006) and would therefore be something of interest to examine in Type D individuals.

Finally, levels of inflammation may also play a role in the pathway underpinning Type D personality and negative health outcomes. Associations have been observed between Type D and heightened levels of pro-inflammatory cytokines (e.g. Conraads et al., 2006) and C - reactive protein (Einvik et al., 2011) in clinical populations. However, the association between Type D and C-reactive protein levels has yet to be examined in the general population.

The aims of the current study are to explore the relationship between Type D and maladaptive sympathetic reactivity to a lab-based stressor using a number of sympathetic measures (cardiovascular reactivity, haemodynamic profile and alpha amylase). It is hypothesised that Type D

personality will be associated with maladaptive cardiovascular reactivity and haemodynamic response to stress, in addition to abnormal alpha amylase output. Further, it is hypothesised that C-reactive protein levels will be positively associated with Type D personality.

Method

Participants

Participants were 75 healthy adults aged between 18-42 years (Mage=23.6years, 64% female, 33 Type D and 42 non-Type D), recruited via email, social media and poster advertising within Northumbria University. Inclusion criteria included good psychological and physical health (no active infections, blood-related disorders, oral diseases) and resting blood pressure no higher than 140/90. Current users of steroidal medication or beta-blockers were excluded. Participants were asked to refrain from smoking or consuming any food or drink for 30 minutes, drinking alcohol for 12 hours, and consuming caffeine or taking part in physical activity for 2 hours prior to the testing session. Participants were compensated £15 for their time. Course credit was also offered to students as an alternative.

Materials

Type D scale 14

Type D personality was assessed using the Type D Scale-14. This questionnaire comprises 7-items measuring negative affect (NA scale) (e.g. 'I often feel unhappy') and a 7-items measuring social inhibition (SI scale) (e.g. 'I often feel inhibited in social situations'). In initial validation studies (Denollet, 2005), both scales were internally consistent (α= 0.88 and α= 0.86), and stable over a 3-month period (r=0.72 and r=0.82).

Multitasking framework

The Multitasking Framework (see Wetherell & Sidgreaves, 2005) was used as the acute stress paradigm. The multitasking framework is a computerised program requiring participants to attend to four tasks simultaneously. The tasks are designed to access different cognitive domains and have an element of time pressure and/or complexity by which they are scored. The cumulative score is

displayed throughout the task. Figure 1 shows the configuration used in the current study. All participants were considered to appropriately engage with all four tasks.

[Figure 1 here]

Scripted statements provided negative verbal feedback on the participant's performance at regular intervals throughout the testing session, similar to a previous study by Wetherell, Craw, Smith, & Smith, (2017).

Saliva sampling

The passive drool technique was implemented to collect saliva. Participants were instructed to allow saliva to pool in the bottom of their mouth, and then pass the saliva through a SalivaBio Collection Aid (SCA) into a 4ml polypropylene tube for 2 minutes. Samples were taken at baseline, pre-stressor, post stressor, in addition to +10min and +20min post stressor. As alpha amylase has a diurnal profile (O'Donnell, Kammerer, O'Reilly, Taylor & Glover, 2009), testing occurred at 2pm each day (14:00). Samples were immediately stored at -20C and transferred to -80C within 24 hours. On day of assay, samples were completely thawed and centrifuged at 1500 × g for 15 minutes. Assays were conducted in-house by a trained technician using a kinetic enzyme assay kit provided by Salimetrics. Saliva flow rate (mL/min) was calculated and alpha amylase output (U/min) computed for each sample. All samples were assayed in duplicate. Intra-assay variation (CV) was computed for the mean of duplicate samples and those with a CV above 15% excluded from analyses. This resulted in 56 participants providing full alpha amylase data (31 non-Type D, 25 Type D). Inter-assay variation was below 15% and therefore deemed acceptable.

Cardiovascular function

Continuous ambulatory measurements of cardiovascular function were recorded using the FMS Portapres (TNO, Biomedical Instrumentation Research Unit, Amsterdam, The Netherlands). The technique requires the participant to wear a finger cuff on the third finger of the non-dominant hand to measure finger arterial pressure. BeatScope 1.0 software analysed arterial pressure waveforms and corrected for pressure wave distortion to provide the following measures: heart rate (HR), systolic

blood pressure (SBP), diastolic blood pressure (DBP) total peripheral resistance (TPR), cardiac output (CO) and stroke volume (SV). These were recorded for approximately 45 minutes per participant.

Blood samples

Intravenous blood samples were obtained by a trained phlebotomist using a 5.0 mL serum separator tube. The tube was inverted 5 times and blood allowed to clot before 15 minutes of centrifugation. Serum was extracted, transferred to a 1.0mL polyethene tube, and stored at –80°C. Samples were fully thawed on day of assay. Assays were conducted by an in-house technician using Abcam's C-reactive protein SimpleStep Enzyme-Linked Immunosorbent Assay (ELISA) kit. Values below sensitivity (detection level) were raised to sensitivity value. Blood samples were obtained from a total of 55 participants (30 non-Type D, 25 Type D).

Procedure

The study received full ethical approval from the institutional ethics committee. Participants attended a single 2 hour testing session in the laboratory. On arrival at the laboratory participants underwent a 30 minute acclimatisation period and completed the Type D scale-14. The baseline saliva sample was taken. The Portapres finger cuff was then attached and baseline cardiovascular measures were taken (10 minutes). The pre-task saliva sample was taken, then participants received verbal task instructions and given a 2-minute practice of the MTF before completing 20 minutes of multitasking with critical evaluation. Once the task was completed the post-task saliva sample was taken and a further 10 minutes of cardiovascular measurements were taken. A fourth saliva sample was obtained 10 minutes post-task and a fifth 20 minutes post-task. A single intravenous blood sample was taken by a phlebotomist at the end of the session. Participants were then debriefed and allowed to leave.

Treatment of data

Cardiovascular data were averaged across the following epochs: Baseline (10 minutes), Practice (2 minutes), Task (20 minutes), Recovery (10 minutes). Before statistical analyses were conducted, scatterplots and histograms were examined to determine the distribution of data, and to identify extreme data points. Where obvious outliers were present, data points that fell 3 standard deviations

above or below the mean were removed, in line with the recommendations of Osborne & Overbay, (2004). In all analyses involving alpha amylase concentration (U/mL) and alpha amylase output (U/min), data was log-transformed due to positive skew.

Type D personality was considered as both a categorical and a dimensional construct within the current study. Traditionally, individuals scoring 10 or above on both scales of the DS14 are classified as Type D, and others non-Type D. However, it has been suggested that Type D may better represented as a dimensional construct (Ferguson et al., 2009), and as such, a continuous measure of Type D was computed using the arithmetic product of the NA and SI scores.

Utilising the categorical approach, mixed factorial ANOVAs assessed changes in the cardiovascular and alpha amylase parameters across the testing period. The within subjects factor was time point and Type D category was the between subjects factor. Using the dimensional approach, a reactivity score (peak value minus baseline value) was calculated for all parameters and hierarchical multiple regression analyses were conducted controlling for the separate effects of negative affect and social inhibition to determine the predictive value of Type D.

Haemodynamic profile (HP) and compensation deficit (CD; the extent to which CO and TPR compensate) scores were computed using the equations proposed by Gregg et al., (2002) and James et al., (2012). Positive haemodynamic profile scores indicate a vascular response, and negative scores indicate a more myocardial response, positive compensation deficit scores indicate an increase in blood pressure, and negative scores represent a decrease in blood pressure. Independent samples t-test were conducted between Type Ds and non-Type Ds on the haemodynamic profile and compensation deficit scores. The changes in these scores were then assessed between baseline and practice (T1), baseline and task (T2) and baseline and recovery (T3), again using mixed factorial ANOVAs. An independent t-test was also used to determine difference in levels of CRP between the Type D groups.

For all ANOVAs Mauchly's test of sphericity was conducted and if violated, Greenhouse Geisser or Huynh-Feldt corrected values were reported as appropriate, otherwise Wilks lambda was used. All

post hoc pairwise comparisons were subject to Bonferroni corrections. A significance alpha level of .05 was used for all analyses. Only significant statistics are reported and post-hoc analyses were conducted as necessary.

Results

Cardiovascular function

Main effects of time and Type D were observed for both systolic (Time: F (2.665, 189.210) = 43.891, p<.001, ηp^2=.382; Type D: F (1, 71) = 4.171, p=.045, ηp^2=.055) and diastolic blood pressure (Time: F (2.477, 175.835) = 47.867, p<.001, ηp^2=.403; Type D: F (1,71) = 7.212, p=.009, ηp^2=.092). Type Ds demonstrated lower systolic and diastolic blood pressure readings than non-Type Ds (see table 1). No significant effects on heart rate were observed. A significant main effect of time on cardiac output (F (2.371, 173.12) = 4.497, p=.008, ηp^2=.058) was also shown with a difference between task and recovery (p=.012).

A significant main effect of time on total peripheral resistance was found (F (1.988, 139.168) = 8.463, p<.001, ηp^2=.108), with differences between baseline and both stressor (p=.003) and recovery (p=.002). A significant interaction effect was also observed (F (1.988, 139.168) = 8.463, p=.044, ηp^2=.044). TPR changed significantly for non-Type Ds (F (3,36) = 4.782, p=.007, ηp^2=.285) between baseline and recovery (p=.018) and practice and recovery (p=.027); and for the Type D group (F (3,30) = 3.164, p=.039, ηp^2=.240) between baseline and recovery [p=.048]).

Stroke volume significantly changed over the stress session (F (2.281, 166.547) = 8.739, p<.001, ηp^2=.107) (all ps<.005 between each time point, with the exception of baseline and recovery, and practice and stressor). There was no effect of Type D, but a significant interaction effect was shown (F (2.281, 166.547) = 3.915, p=.017, ηp^2=.051). For the non-Type D group, there was a significant change in stroke volume for both non-Type Ds (F (3, 36) = 7.192, p=.001, ηp^2=.356) (differences between; baseline and practice [p=.008]; practice and recovery [p=.006]; and stressor and recovery [p=.038]) and Type Ds (F (3, 30) = 5.685, p=.003, ηp^2=.362) (differences between baseline and practice [p=.007], and baseline and stressor [p=.001]).

The only significant regression model was observed for stroke volume reactivity showing SI (β = .318, p=.020) was a significant predictor at Step 1, predicting a significant 9.8% of variance (F (2, 69) = 3.732, p =.029, ΔR^2=.098*). In the model at step 2 (F (3, 68) =4.220, p=.009 ΔR^2= .059*) Type D (β = .904, p=.032) significantly predicted an additional 5.9% of the variance.

Cardiovascular data are displayed in table 1.

[Table 1 here]

Haemodynamic profile and compensation deficit

No significant Type D differences were observed for haemodynamic profile or compensation deficit total scores. However, there was a significant effect of time (F (1.484, 103.874) = 5.780, p=.009, ηp^2=.063) on changes in haemodynamic profile showing differences between T1 (practice-baseline) and T3 (recovery-baseline) (p=.037), and between T2 (task-baseline) and T3 (p=.022). The interaction was also significant (F (1.484, 103.874) = 4.097, p=. 030, ηp^2=.055). Haemodynamic profile scores significantly changed across the 3 time points for the non-Type D group (F (2, 37) = 4.329, p=.020, ηp^2=.186) (differences between T1 and T3 (p=.015), and between T2 and T3 (p=.047) but not for the Type D group.

Compensation deficit scores changed significantly over the testing session (F (1.643, 114.996) = 3.468, p=.042, ηp^2=.033) but the only significant difference was between T1 and T2 (p=.002). Changes in haemodynamic profile and compensation deficit scores can be observed in figure 2.

[Figure 2 here]

Salivary alpha amylase

A significant main effect of time was shown for both alpha amylase concentration (F (4,51) = 5.092, p=.002, ηp^2=.285)(differences between baseline and both post-task [p=.005], and +20 minutes [p=.014]) and alpha amylase output (F (3.260, 176.047) = 20.006, p<.001, ηp^2=.270) (differences between baseline and all time points [ps<.05], between pre-task and post-task [p<.001], and between post-task and +10 minutes [p<.001]). The main effect of Type D on alpha amylase output approached significance (F (1,54) = 3.416, p=.070, ηp^2=.059) and post hocs showed a significant Type D difference

at +20minutes (p=.040). The regression models for alpha amylase concentration and output were both non-significant. Table 2 reports mean values for alpha amylase concentration and alpha amylase output.

[Table 2 here]

C - reactive protein

No significant Type D differences in C-reactive protein concentrations were observed and correlational analyses with continuous Type D, NA and SI scores were also non-significant.

Discussion

The aim of the current study was to examine patterns of sympathetic activity in response to an acute stressor in Type D individuals via the measurement of a number of cardiovascular parameters and sympathetic biomarkers.

In line with the well-documented effects of acute stress on blood pressure (e.g. Vrijkotte, van Doornen & de Geus, 2000; Wetherell & Carter, 2014), both systolic and diastolic measures increased initially then began to reduce in the recovery phase. Interestingly, similar to the findings of Kelly-Hughes et al., (2014), Type D individuals exhibited lower blood pressure levels (both systolic and diastolic) than non-Type Ds. Stroke volume also increased from baseline to practice; and then reduced between stress exposure and recovery in non-Type D but not Type Ds. Reactivity of stroke volume was also the only cardiovascular parameter significantly associated with continuous Type D scores. Previously, acute stress has been found to lead to decreases in stroke volume (Matthews, Salomon, Brady & Allen, 2003), which may be reflected in the decrease in stroke volume observed in non-Type D individuals after the practice, suggesting the Type D response observed may represent underlying cardiovascular dysregulation.

However, it is suggested that the measurement of cardiovascular parameters alone reveals little about key underlying physiological processes (James et al., 2012). Therefore, as blood pressure is underpinned by more complex haemodynamic parameters and homeostatic regulation, the lack of

interaction effects evident for the blood pressure measures are not necessarily indicative of an absence of Type D differences in cardiovascular reactivity. The interaction effect observed for total peripheral resistance suggests that reactivity differs between Type D groups. Total peripheral resistance increased in response to the stressor in non-Type Ds but not Type Ds, yet in both groups was higher in recovery as compared to baseline. This may suggest that the multitasking framework initially evokes a mixed haemodynamic response (i.e. cardiac output and total peripheral resistance both increase or remain the same), which then changes to vascular (i.e. total peripheral resistance increases while cardiac output decreases) between the stress and recovery phases.

With regards to haemodynamic profile, scores did not differ between practice, task or recovery in Type Ds, but were elevated during both practice and task in the non-Type Ds. As there was a change in haemodynamic profile for non-Type Ds but not Type Ds, this suggests that Type Ds may exhibit a maladaptive pattern of haemodynamic profile reactivity. Therefore, according to James et al., (2012) the increases in blood pressure observed for Type Ds could be due to a 'mixed' (scores close to 0) haemodynamic profile, whereas for non-Type Ds the increase in blood pressure observed was due to an initial 'myocardial' profile (score below 0) which then changed to a 'vascular' (increased scores) profile. A vascular profile is seen as typically a "more healthy" response (Eliot et al., 1982). These findings appear to mirror previous findings (Kupper, Pelle, & Denollet, 2013) which observed an exaggerated haemodynamic profile in Type Ds response to a cold pressor task. Further, as suggested by Howard et al., (2011), it can be argued that a maladaptive (blunted) haemodynamic profile in Type D individuals may underpin the link with poor physical health. It is important to understand how hemodynamic reactivity may differ in Type D individuals for future research. As such, these findings may inform studies wishing to examine behavioural interventions aimed at changing haemodynamic profiles to provide long-term health benefits (e.g. exercise and weight management strategies).

In terms of the alpha amylase results, the multitasking framework induced a response in both alpha amylase concentration and output across the testing period. These findings corroborate literature demonstrating alpha amylase reactivity to acute stress (Nater et al., 2006; Rohleder et al.,

2004, 2006). The current study is the first to test and observe alpha amylase reactivity to multitasking, and thus provides further evidence that i) alpha amylase can be a reliable biomarker of sympathetic activation and ii) the multitasking framework activates the sympathetic adrenal medullary axis. However, no Type D differences in alpha amylase reactivity were observed.

Levels of serum C-reactive protein were not found to be related to Type D personality in the current study. However, as the current sample comprised of healthy young adults, it could be suggested that heightened levels of inflammation could be a consequence of health problems which manifest later in the progression of cardiac illnesses (Mommersteeg et al., 2012).

The current study has various methodological strengths. Firstly, the multitasking framework is an ecologically valid acute stress paradigm that reflects multitasking demands an individual may experience in the real world (Kelly-Hughes et al., 2014; Wetherell & Carter, 2014). The additional negative feedback provided by the researcher strengthened the validity of the stressor (Wetherell et al., 2017). However, the limitation of a laboratory-based paradigm must still be considered. Given the socially inhibited nature of Type D individuals, use of a real-world socially salient stressor such as a public speaking task (e.g. Trier Social Stress Test; Kirschbaum et al., 1993) may be useful in future Type D research. Further strengths include the comprehensive range of beat-to-beat haemodynamic data and the use of the gold standard (DeCaro, 2008) passive drool technique to collect saliva which was recommended in order to calculate flow rate (Beltzer et al., 2010).

A major limitation of the study design was the timing of the blood draw (on the same day as the stressor) which may have elicited an anticipatory stress response as participants approached the end of the stress task. Anticipation of blood draws has been found to evoke various psychobiological responses to stress (Mills & Krantz, 1979). Alternatively, this element could be viewed as contributing to the ecological validity of the stressor. Measurement of C-reactive protein levels in saliva were considered, but not recommended (Dillon et al., 2010). Therefore, future studies may wish to employ a blood draw on a separate day.

In summary, Type D personality was associated with lower basal systolic and diastolic blood pressure, blunted reactivity of total peripheral resistance, and reduced recovery of stroke volume, in response to stress. Type D appears to be related to maladaptive changes in haemodynamic profile which may be viewed as unhealthy (less vascular than non-Type Ds). These abnormalities can be postulated as evidence of a maladaptive cardiovascular mechanism which may underpin the link between the Type D personality and ill-health. Further, levels of alpha amylase were not related to Type D personality; however, there was evidence of alpha amylase responses to the stressor. Nevertheless, given the cardiovascular findings, the Type D-health relationship may be underpinned by sympathetic dysregulation, particularly maladaptive changes in the haemodynamic profile in response to stress.

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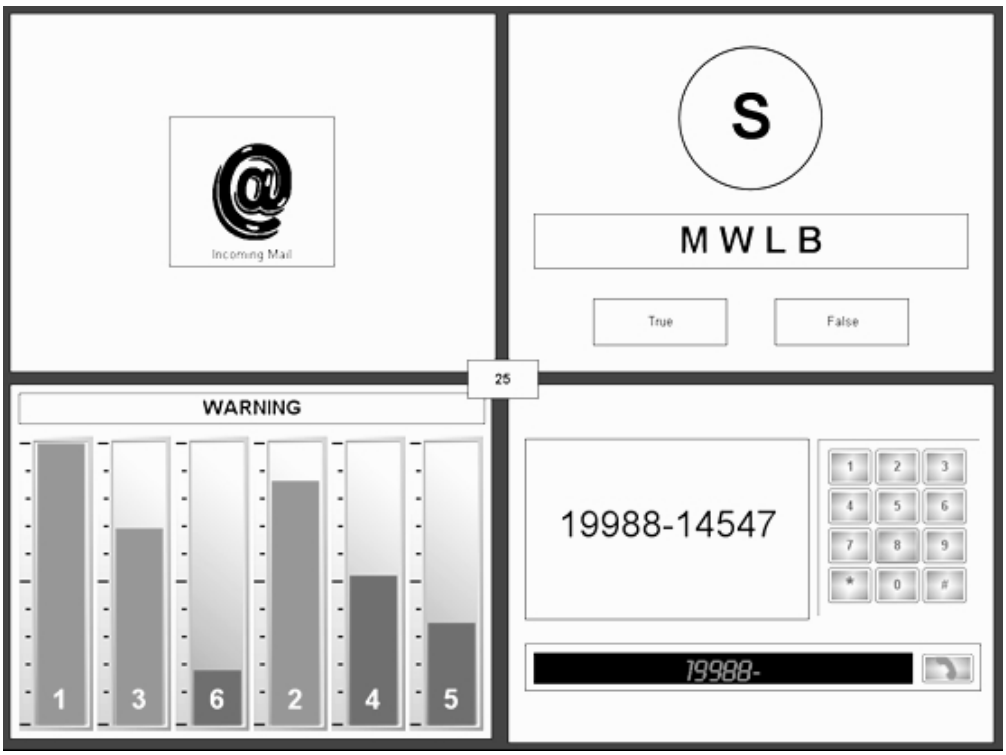

Figure 1. Multitasking framework modules employed in the current study; the mail alert (top left), memory search (top right), bar tracker (bottom left) and telephone number entry (bottom right

Table 1. Mean values [SD] of SBP, DBP, HR and CO at each time point for Type D (n=33) and non- Type D (n=42) participants

		Timepoint			
	Group	*Baseline*	*Practice*	*Task*	*Recovery*
SBP (mmHg)	*Type D*	116.28* [13.17]	122.66 [12.51]	123.84 [13.01]	121.44* [13.52]
	non - Type D	121.95* [12.62]	128.16 [13.71]	130.38 [15.24]	128.67* [14.06]
DBP (mmHg)	*Type D*	69.45* [6.88]	73.13* [6.70]	73.81* [6.60]	72.34* [7.39]
	non - Type D	73.57* [7.29]	77.01* [8.16]	78.63* [8.70]	78.02* [8.57]
HR (bpm)	*Type D*	79.28 [10.73]	77.53 [10.48]	78.25 [10.66]	77.98 [10.65]
	non - Type D	79.78 [10.08]	79.58 [12.15]	79.75 [11.97]	79.81 [11.26]
CO (L/min)	*Type D*	6.20 [1.41]	6.31 [1.39]	6.42 [1.39]	6.28 [1.37]
	non - Type D	6.38 [1.38]	6.57 [1.48]	6.47 [1.44]	6.25 [1.56]
TPR (mmHg/min/mL^{-1})	*Type D*	0.897 [0.196]	0.926 [0.213]	0.924 [0.215]	0.930 [0.232]
	non - Type D	0.887 [0.185]	0.896 [0.200]	0.926 [0.213]	0.954 [0.264]
SV (mL)	*Type D*	78.55 [14.22]	81.82 [14.31]	82.32 [14.39]	81.14 [14.39]
	non - Type D	80.64 [15.69]	83.24 [16.31]	81.73 [16.11]	79.02 [17.83]

** Indicates a significant difference between Type D groups (α=.05)*

Table 2. Mean values [SD] of sAA output and sAA concentration at each time point for Type D (n=25) and non-Type D (n=31) participants

		Time point				
	Group	*Baseline*	*Pre-task*	*Post- task*	*+ 10 minutes*	*+ 20 minutes*
sAA output (U/min)	*Type D*	25.72 [21.43]	31.77 [18.60]	56.17 [45.52]	34.89 [26.13]	43.10 [26.07]
	non - Type D	19.36 [16.05]	26.93 [19.47]	49.56 [44.29]	27.75 [25.80]	29.34 [22.54]
sAA concentration (U/mL)	*Type D*	48.90 [30.49]	50.39 [27.54]	61.98 [38.99]	51.60 [32.03]	59.60* [33.95]
	non -Type D	42.94 [39.74]	54.64 [43.98]	58.94 [43.43]	40.80 [27.01]	48.66* [35.56]

**Indicates a significant difference between Type D groups (α=.05)*

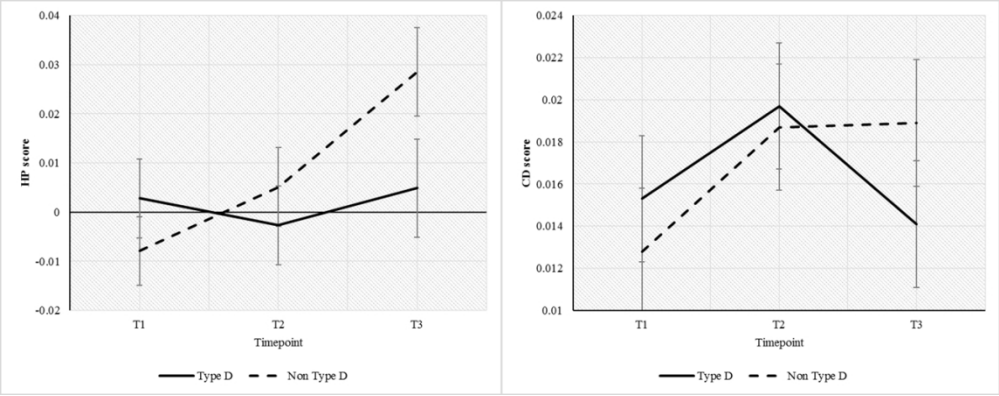

Figure 2. Patterns of underlying determinants of haemodynamic profile (left) and compensation deficit (right) across the testing session in Type D and non-Type D individuals (error bars represent standard error).