THE ACTION DYNAMICS OF APPROACH-AVOIDANCE CONFLICT DURING DECISION-MAKING

Supplementary Information

Santiago Garcia-Guerrero¹, Denis O’Hora¹, Arkady Zgonnikov¹, & Stefan Scherbaum²

¹ National University of Ireland, Galway
² Technische Universität Dresden
1.0 Average response trajectory profiles per level of avoidance. Figure S1 below shows the average responses trajectories for both non-threat (safe) and the trials with shock probability (threat), for the different avoidance subgroups in both experiments.

When it was safe to choose (non-threat trials), responses exhibited relatively straight and uniform trajectories. By comparison, in the face of threat, trajectories were more complex and this complexity was influenced by the response chosen and level of avoidance. For example, responses by Low (i.e. rare) Avoiders when choosing “Take” exhibited less attraction towards the safe “Lose” option in comparison to Moderate Avoiders and High Avoiders. Moreover, when deciding to avoid the threat option, Low Avoiders did so later (i.e., higher on the y-axis) than Moderate Avoiders and High Avoiders.

![Figure S1. Averaged response trajectories per choice option (L, T), trial type (safe, threat) and avoidance level grouping (High Avoiders in red, Moderate Avoiders in blue, and Low Avoiders in green). The ordinate represents the height of the computer screen in pixels, the abscissa the width. Since response options changed positions, for comparative purposes, response trajectories have been remapped so responses to the left represent avoiding (i.e., choosing “L”) and responses to the right represent approaching (i.e., choosing “T”). Equally, the y-axis of the screen is inverted and the x-coordinates are rescaled so the starting middle position corresponds to 0, 0 coordinates, with leftward responses taking negative values on the x-axis and rightward responses being positive. Participants were grouped based on their indifference points (see Data processing): indifference point above 7 = High Avoiders; indifference point below 3 = Low Avoiders.](image-url)
2.0 Mixed-effects models. The Tables S1 to S10 present comparative fits for each of the mixed-effects regression models and their respective predictor variables, for both experiments. The absolute values of the variable Target Valence were used for these models, and Trial underwent logarithmic transformation. Except for the models in Table S1 and Table S6, the slope and intercept of Target Valence were allowed to vary per participant.

Experiment 1

Table S1

| Generalized linear binomial mixed-effects models predicting approach responses |
|----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Model                           | No.   | df    | AIC   | BIC   | logLik | Deviance | Chi sq. | Chi df | Pr(>Chisq) |
| Random effects                  |       |       |       |       |        |          |         |        |            |
| Participant                     | 1     | 2     | 5733.3| 5746.7| -2864.6| 5729.3   |         |        |            |
| Target (slope) by Participant   | 2     | 2     | 6990.2| 7003.7| -3493.1| 6986.2   | 0       | 0      | 1          |
| Target (slope and intercept) byParticipant | 3 | 4     | 3531.9| 3558.9| -1762.0| 3523.9   | 3462.3  | 2      | < .001     |
| Fixed effects                   |       |       |       |       |        |          |         |        |            |
| Model 3 + Target                | 4     | 5     | 3472.1| 3505.8| -1731.1| 3462.1   | 61.814  | 1      | < .001     |

Table S2

| Linear mixed-effects models used to predict log transformed response time |
|----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Model                           | No.   | df    | AIC   | BIC   | logLik | Deviance | Chi sq. | Chi df | Pr(>Chisq) |
| Random effects                  |       |       |       |       |        |          |         |        |            |
| Participant                     | 1     | 3     | 2922.4| 2942.6| -1458.2| 2916.4   |         |        |            |
| Target Valence (slope and intercept) by Participant | 2 | 5     | 2720.1| 2753.8| -1355.1| 2710.1   | 206.29  | 2      | < .001     |
| Fixed effects                   |       |       |       |       |        |          |         |        |            |
| Model 2 + Trial                 | 3     | 6     | 2624.4| 2664.9| -1306.2| 2612.4   | 97.712  | 1      | < .001     |
| Model 3 + Target Val.           | 4     | 7     | 2585.1| 2632.3| -1285.6| 2571.1   | 41.288  | 1      | < .001     |
| Model 4 + Approach * Target Valence | 5 | 9     | 2565.7| 2626.3| -1273.8| 2547.7   | 23.467  | 2      | < .001     |

Table S3

| Linear mixed-effects models used to predict Maximum Absolute Deviation of response trajectories |
|----------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|
| Model                           | No.   | df    | AIC   | BIC   | logLik | Deviance | Chi sq. | Chi df | Pr(>Chisq) |
| Random effects model            |       |       |       |       |        |          |         |        |            |
| Participant                     | 1     | 3     | 85730 | 85750 | -42862 | 85724    |         |        |            |
| Target Valence (slope and intercept) by Participant | 2 | 5     | 85606 | 85640 | -42798 | 85596    | 127.88  | 2      | < .001     |
| Fixed effects                   |       |       |       |       |        |          |         |        |            |
| Model 2 + Trial                 | 3     | 6     | 85586 | 85626 | -42787 | 85574    | 22.820  | 1      | < .001     |
| Model 3 + Target Val.           | 4     | 7     | 85572 | 85619 | -42779 | 85558    | 15.296  | 1      | < .001     |
| Model 4 + Approach * Target Valence | 5 | 9     | 84712 | 84773 | -42347 | 84694    | 864.047 | 2      | < .001     |
Table S4

Poisson generalized linear mixed-effects models used to predict x-flips during response trajectories

| Model                     | Random effects | Fixed effects |
|---------------------------|----------------|--------------|
|                           | Participant    | Model 2 + Target Val. | Model 3 + Trial | Model 4 + Target Valence * Approach |
|                           | Target Valence (slope and intercept) by Participant |                      |              |                                    |
| Model No.                 | df  | AIC  | BIC  | logLik  | Deviance  | Chi sq. | Chi df | Pr(>Chisq) | df  | AIC  | BIC  | logLik  | Deviance  | Chi sq. | Chi df | Pr(>Chisq) | df  | AIC  | BIC  | logLik  | Deviance  | Chi sq. | Chi df | Pr(>Chisq) |
| Participant               | 1   | 2    | 19262 | 19275 | -9628.8 | 19258    |        |        | < .001     | 3   | 5    | 19223 | 19257 | -9606.6 | 19213    | 22.291 | 1        | < .001     | 4   | 6    | 19179 | 19219 | -9583.5 | 19167    | 46.328 | 1        | < .001     | 5   | 8    | 19165 | 19219 | -9574.3 | 19149    | 18.311 | 2        | < .001     |
| Target Valence (slope and intercept) by Participant | 2   | 4    | 19244 | 19271 | -9617.8 | 19236    | 22.08  | 2       | < .001     | 2   | 5    | 19223 | 19257 | -9606.6 | 19213    | 22.291 | 1        | < .001     | 4   | 6    | 19179 | 19219 | -9583.5 | 19167    | 46.328 | 1        | < .001     | 5   | 8    | 19165 | 19219 | -9574.3 | 19149    | 18.311 | 2        | < .001     |

Table S5

Linear mixed-effects models used to predict sample entropy of response trajectories

| Model                     | Random effects | Fixed effects |
|---------------------------|----------------|--------------|
|                           | Participant    | Model 2 + Target Val. | Model 3 + Trial | Model 4 + Approach * Target Valence |
|                           | Target Valence by Participant |                      |              |                                    |
| Model No.                 | df  | AIC  | BIC  | logLik  | Deviance  | Chi sq. | Chi df | Pr(>Chisq) | df  | AIC  | BIC  | logLik  | Deviance  | Chi sq. | Chi df | Pr(>Chisq) | df  | AIC  | BIC  | logLik  | Deviance  | Chi sq. | Chi df | Pr(>Chisq) |
| Participant               | 1   | 3    | -10535 | -10515 | 5270.3  | -10541  |        |        | < .001     | 3   | 6    | -10600 | -10569 | 5310.7   | -10621  | 18.292 | 1        | < .001     | 4   | 7    | -10631 | -10584 | 5322.3   | -10645  | 23.130 | 1        | < .001     | 5   | 9    | -10703 | -10643 | 5360.4   | -10721  | 76.287 | 2        | < .001     |
| Target Valence (slope and intercept) by Participant | 2   | 5    | -10593 | -10560 | 5301.6  | -10603  | 62.498 | 2       | < .001     | 2   | 5    | -10669 | -10569 | 5310.7   | -10621  | 18.292 | 1        | < .001     | 4   | 7    | -10631 | -10584 | 5322.3   | -10645  | 23.130 | 1        | < .001     | 5   | 9    | -10703 | -10643 | 5360.4   | -10721  | 76.287 | 2        | < .001     |

Table S6

Generalized linear binomial mixed-effects models predicting approach responses

| Model                     | Random effects | Fixed effects |
|---------------------------|----------------|--------------|
|                           | Participant    | Model 3 + Target |
|                           | Target (slope) by Participant |              |
|                           | Target (slope and intercept) by Participant |              |
| Model No.                 | df  | AIC  | BIC  | logLik  | Deviance  | Chi sq. | Chi df | Pr(>Chisq) | df  | AIC  | BIC  | logLik  | Deviance  | Chi sq. | Chi df | Pr(>Chisq) |
| Participant               | 1   | 2    | 4231.3 | 4244.6 | -2113.7 | 4227.3  |        |        |              | 4   | 5    | 2495.2 | 2528.4 | -1242.6 | 2485.2  | 52.77  | 1        | < .001     |
| Target Valence by Participant | 2   | 2    | 5484.1 | 5497.4 | -2740.1 | 5480.1  | 0      | 0       | 1            | 4   | 5    | 2495.2 | 2528.4 | -1242.6 | 2485.2  | 52.77  | 1        | < .001     |
| Target (slope and intercept) by Participant | 3   | 4    | 2546.0 | 2572.5 | -1269.0 | 2538.0  | 2942.1 | 2       | < .001     | 4   | 5    | 2495.2 | 2528.4 | -1242.6 | 2485.2  | 52.77  | 1        | < .001     |

Table S7

Mixed-effects models used to predict log transformed response time

| Model                     | Random effects | Fixed effects |
|---------------------------|----------------|--------------|
|                           | Participant    | Model 2 + Trial |
|                           | Target Valence (slope and intercept) by Participant |              |
| Model No.                 | df  | AIC  | BIC  | logLik  | Deviance  | Chi sq. | Chi df | Pr(>Chisq) | df  | AIC  | BIC  | logLik  | Deviance  | Chi sq. | Chi df | Pr(>Chisq) |
| Participant               | 1   | 3    | 2857.8 | 2877.7 | -1425.9 | 2851.8  |        |        |              | 3   | 6    | 2799.0 | 2838.8 | -1393.5 | 2787.0  | 12.625 | 1        | < .001     |
| Target Valence (slope and intercept) by Participant | 2   | 5    | 2809.7 | 2842.8 | -1399.8 | 2799.7  | 52.167 | 2       | < .001     | 3   | 6    | 2799.0 | 2838.8 | -1393.5 | 2787.0  | 12.625 | 1        | < .001     |
### Table S8

**Mixed-effects models used to predict Maximum Absolute Deviation of response trajectories**

| Model                           | No. | df | AIC  | BIC  | logLik | Deviance | Chi sq. | Chi df | Pr(>Chisq) |
|---------------------------------|-----|----|------|------|--------|----------|---------|--------|-------------|
| **Random effects**              |     |    |      |      |        |          |         |        |             |
| Participant                     | 1   | 3  | 76990| 77010| -38492 | 76984    |          |        |             |
| Target Valence (slope and intercept) by Participant | 2   | 5  | 76973| 77006| -38482 | 76963    | 21.126  | 2      | <.001       |
| **Fixed effects**               |     |    |      |      |        |          |         |        |             |
| Model 2 + Trial                 | 3   | 6  | 76973| 77013| -38480 | 76961    | 2.2372  | 1      | .134        |
| Model 3 + Target Val.           | 4   | 7  | 76968| 77014| -38477 | 76954    | 7.1443  | 1      | .007        |
| Model 4 + Approach *            | 5   | 8  | 76770| 76830| -38376 | 76752    | 201.540 | 1      | <.001       |

### Table S9

**Poisson generalized linear mixed-effects models used to predict x-flips during response trajectories**

| Model                           | No. | df | AIC  | BIC  | logLik | Deviance | Chi sq. | Chi df | Pr(>Chisq) |
|---------------------------------|-----|----|------|------|--------|----------|---------|--------|-------------|
| **Random effects**              |     |    |      |      |        |          |         |        |             |
| Participant                     | 1   | 2  | 17262| 17275| -8628.8| 17258    |          |        |             |
| Target Valence (slope and intercept) by Participant | 2   | 4  | 17263| 17289| -8627.4| 17255    | 2.8163  | 2      | .244        |
| **Fixed effects**               |     |    |      |      |        |          |         |        |             |
| Model 2 + Trial                 | 3   | 5  | 17259| 17292| -8624.5| 17249    | 5.7741  | 1      | .016        |
| Model 3 + Target Val.           | 4   | 6  | 17256| 17296| -8621.9| 17244    | 5.2106  | 1      | .022        |
| Model 4 + Approach *            | 5   | 8  | 17242| 17295| -8613.1| 17226    | 17.5659 | 2      | <.001       |

### Table S10

**Mixed-effects models used to predict sample entropy in response trajectories**

| Model                           | No. | df | AIC  | BIC  | logLik | Deviance | Chi sq. | Chi df | Pr(>Chisq) |
|---------------------------------|-----|----|------|------|--------|----------|---------|--------|-------------|
| **Random effects**              |     |    |      |      |        |          |         |        |             |
| Participant                     | 1   | 3  | -11552| -11532| 5779.1 | -11558   |          |        |             |
| Target Valence (slope and intercept) by Participant | 2   | 5  | -11557| -11524| 5783.7 | -11567   | 9.2201  | 2      | .009        |
| **Fixed effects**               |     |    |      |      |        |          |         |        |             |
| Model 2 + Trial                 | 3   | 6  | -11565| -11525| 5788.3 | -11577   | 9.2563  | 1      | .002        |
| Model 3 + Target Val.           | 4   | 7  | -11568| -11522| 5791.0 | -11582   | 5.5106  | 1      | .018        |
| Model 4 + Approach *            | 5   | 9  | -11607| -11547| 5812.3 | -11625   | 42.5606 | 2      | <.001       |
3.0 Psychometric questionnaires. The BIS/BAS scale was developed to assess individual sensitivity of an individual’s motivational/behavioral systems of approach (BAS), which regulates appetitive motives toward something desired, and their behavioral avoidance—or inhibition—system (BIS), which regulates aversive motives to move away from something unpleasant. Each item on this questionnaire is a statement (e.g., “A person’s family is the most important thing in life”) to which a participant may either agree or disagree (1 = very true for me, 2 = somewhat true for me, 3 = somewhat false for me, 4 = very false for me). The initial test-retest reliability correlation of the individual subscales of the BIS/BAS is reported to be .66 for BIS and .59 for BAS (Carver, & White, 1994).

Theoretically, participants’ degree of approach or avoidance in the task could depend on their (“state/trait”) behavioral disposition; that is, high approaching participants (with high BAS scores) could be expected to differ from avoiders by having a lower indifference point (see Data Processing). We included this measure as an exploratory endeavor as the structure of the BIS-BAS questionnaire implies fundamentally different mechanisms of interaction between these systems compared to the assumptions present in our AAC framework (based on Lewis's [1935], and Miller's [1944] original formulations). Moreover, despite many studies having provided cross validation data around the construct validity of the BIS/BAS compared to other personality questionnaires (e.g., Jorm et al., 1999; Ross, Benning, Patrick, Thompson, & Thurston, 2009; Vandeweghe et al., 2016), very few studies have related the BIS/BAS scales to behavioral outcome variables (e.g., Poythress et al., 2008), and the underlying theory of the scale has been reformulated (McNaughton & Gray, 2000; McNaughton & Corr, 2008).

The BEAQ consists of a 15-item short version of a questionnaire to assess unwillingness to remain in contact with any type of distressing experience (emotions, thoughts, memories, physical sensations), and hence a tendency to engage in any activity that reduces such an experience (e.g., physical/emotional distancing, compulsive rituals, etc.). Each statement (e.g., “I rarely do something if there is a chance that it will upset me”) is answered in accordance to a 6-point Likert scale indicating level of agreement. The BEAQ seems to moderately correlate with other self-report measures of avoidance (mean r = .52), and it has satisfactory internal consistency with Cronbach’s alphas ranging from .80 to .89 (Gámez, et al., 2014). We considered this questionnaire as a potentially viable alternative to the BIS/BAS. However, it is important to note that this questionnaire has not yet received extensive use in the literature (cf. Bardeen, Fergus, & Orcutt, 2014; Fergus, 2015; Tyndall et al., 2019), and, to our knowledge, no test–retest reliability has been conducted.

The FPQ-III is a 30-item questionnaire designed to assess fear and anxiety associated with pain. The measure consists of three subscales: fear of severe pain (e.g. “Breaking your leg”), fear of minor pain (e.g., “Getting a paper-cut on your finger”) and fear of medical pain (e.g., “Receiving an injection in your hip”). Items are scored on a 5-point Likert scale ranging from 1 (not at all) to 5 (extreme). Only the minor pain scale was implemented in the present study, whose reported alpha coefficient and test-retest reliability are .87 and .73 respectively.
3.1 Task-related questions. Participants in both experiments completed a set of questions relating their experiences of the protocol. Figure S4 depicts the percent of respondents that provided responses at each level of the Likert scale. The percentage provided is based on the combination of responses from Experiment 1 and Experiment 2. On the whole, the responses indicate that participants engaged with the protocol as expected (e.g., they were motivated to earn points and complete the paradigm quickly).

Figure S4. Proportion of answers to task related questions. The order of the questions has been rearranged in accordance to the diverging stacked bar charts. The left column shows the statements to which participants indicated their responses in accordance to the 5-point Likert scales (response labels at the bottom of each set). The bars to the right of each statement shows the distribution of the participants’ answers to them. This graph was done using the “HH” R package (Heiberger, 2018; Heiberger & Robbins, 2014—with a slight modification in the code to include the percentages within each response level).
4.0 Experimental Instructions

4.1 Preliminary task instructions. Displayed at the start of the task:

The following task consists of trials in which you can choose to earn or lose points.

After pressing the "start" button, two selection buttons will appear at the upper corners of the screen: "T" stands for "take it", whereas "L" stands for "Lose it".

As you start moving your cursor upwards a number will appear on the screen, this represents the points that you can either decide to "take" or "lose", by clicking on the corresponding buttons "T" or "L".

On occasions, the number will appear in red colour. When this happens, there is a 20 % probability of receiving a mild shock if you choose to take the points displayed (selecting "T"). This probability is constant and does not depend on the point values (i.e., higher points will not have higher shock probability).

Selections of "L" will never be accompanied by a shock.

Each trial-block will terminate upon completing the specified number of points, displayed at the beginning of each block.

Remember: the more points you "take" the quicker you get through a block; the more you lose by avoiding the red numbers the longer it will take you to complete a block of trials. So the decision is yours. You can choose "safely" and take more time, or take "your chances" and spend less time in the task.

Please try to make your selections as quickly as possible, when you see the number.

When you're ready to continue just click.

And, each trial-block was followed by:

Well done! You've completed this block.

Take a couple of minutes if you need.

When you're ready to continue, please position yourself back in the frame, and click with the mouse.
4.2 Setting up and calibration of the electric stimulator.

Verbal explanation and instructions given to the participant after placing the electrodes:

“Here we have a scale that goes from 0 to 7, and a representation of the dial that controls the intensity of the electric discharge. When I press this button down [the initiator] I’ll be delivering a discharge, and I want you to let me know how much you felt that stimulation by rating it in accordance to this scale; for example, if you didn’t feel anything, you draw a zero underneath the level 1 and so on and so forth”.

This rating procedure was repeated for each increasing unit of electric discharge until participants request to stop, provided a rating of “6 – strong”, or the maximum level of amplitude was reached.

When the desired level of stimulation was reached, the following was explained:

“So it seems that we’ve reached your tolerance level. I take it that you wouldn’t like the stimulation to increase any further, correct?..So if that is ok with you, this will be the intensity we’ll keep for the duration of the task”.

4.3 Perception scale used during the setup of the ISWS stimulator.

The perception scale used contains the dials and values (indicated in red) controlling the intensity of the electric pulse. The top shows the dials corresponding to event/sec and duration whose values are set for all participants. The rightmost dial corresponds to the amplitude of the pulse, which will vary across participants depending on their particular perception thresholds. The two rows of dials underneath, thus, represent each of the ten amplitude increases participants are asked to sample.

For each amplitude unit delivered, the participant provides a subjective rating of discomfort in accordance to the perception scale values at the bottom: a 7-point Likert scale (0 = "not sensation at all", 4 = "moderately uncomfortable", 7 = "painful"). These ratings are written beneath each of the amplitude dials being sampled (such record is then kept for each participant).
5.1 Action Dynamics Indices (Expt 1)

(left column: all participants, right column: excluding consistent responders)
5.2 Action Dynamics Indices (Expt 2)

(left column: all participants, right column: excluding consistent responders)
### 6.0 Robustness Checks of Statistics on Action Dynamics Indices (Expt 1)

Log(RT) and MAD

|                      | All Participants | Excluding Consistent Avoiders and Non-Avoiders | Controlled for EqPt Interactions |
|----------------------|------------------|-----------------------------------------------|---------------------------------|
| **RT**               |                  |                                               |                                 |
| (Intercept)          | 6.995            | 7.091                                         | 7.09                            |
| Std. Error           | 0.029            | 0.026                                         | 0.023                           |
| t value              | 245.396          | 273.506                                       | 305.307                         |
| Trial Number (log)   | -0.041           | -0.033                                        | -0.04                           |
| Std. Error           | 0.004            | 0.005                                         | 0.004                           |
| t value              | -9.694           | -6.25                                         | -9.673                          |
| Target Valence (centred) | -0.03        | -0.04                                         | -0.024                          |
| Std. Error           | 0.004            | 0.005                                         | 0.005                           |
| t value              | -7.235           | -7.808                                        | -4.461                          |
| Response (Approach + vs Avoid -) | 0.057       | 0.047                                         | -0.001                          |
| Std. Error           | 0.012            | 0.011                                         | 0.017                           |
| t value              | 4.905            | 4.347                                         | -0.073                          |
| Target Valence by Response | 0.01        | 0.012                                         | 0.004                           |
| Std. Error           | 0.005            | 0.006                                         | 0.006                           |
| t value              | 2.205            | 1.949                                         | -0.619                          |
| **MAD**              |                  |                                               |                                 |
| (Intercept)          | 346.74           | 403.334                                       | 396.212                         |
| Std. Error           | 16.463           | 21.905                                        | 16.853                          |
| t value              | 21.062           | 18.413                                        | 23.51                           |
| Trial Number (log)   | -20.541          | -13.333                                       | -19.422                         |
| Std. Error           | 3.027            | 4.122                                         | 2.987                           |
| t value              | -6.785           | -3.235                                        | -6.502                          |
| Target Valence (centred) | -11.757      | -12.927                                       | -8.479                          |
| Std. Error           | 2.603            | 4.002                                         | 3.492                           |
| t value              | -4.517           | -3.23                                         | -2.428                          |
| Response (Approach + vs Avoid -) | -209.785     | -227.836                                      | -236.349                        |
| Std. Error           | 7.951            | 8.599                                         | 9.857                           |
| t value              | -26.384          | -26.497                                       | -23.978                         |
| Target Valence by Response | 3.545      | -3.278                                        | -3.361                          |
| Std. Error           | 3.121            | 4.765                                         | 4.21                            |
| t value              | 1.136            | -0.688                                        | -0.798                          |
### 6.1 Robustness Checks of Statistics on Action Dynamics Indices (Expt 1)

X-Flips and Sample Entropy

|                      | All Participants | Excluding Consistent Avoiders and Non-Avoiders | Controlled for EqPt Interactions |
|----------------------|------------------|-----------------------------------------------|---------------------------------|
|                      | Estimate | Std. Error | z value | Estimate | Std. Error | z value | Estimate | Std. Error | z value |
| (Intercept)           | 0.447    | 0.06      | 7.456   | 0.649    | 0.047      | 13.949  | 0.598    | 0.05      | 11.925  |
| Trial Number (log)   | -0.077   | 0.011     | -7.118  | -0.05    | 0.013      | -3.712  | -0.076   | 0.011     | -6.93   |
| Target Valence (centred) | -0.035  | 0.009     | -3.735  | -0.02    | 0.011      | -1.887  | -0.013   | 0.012     | -1.057  |
| Response (Approach + vs Avoid -) | -0.098  | 0.03      | -3.23   | -0.116   | 0.027      | -4.268  | -0.164   | 0.034     | -4.789  |
| Target Valence by Response | 0.006   | 0.012     | 0.476   | -0.016   | 0.015      | -1.059  | -0.012   | 0.015     | -0.827  |

|                      | Estimate | Std. Error | t value | Estimate | Std. Error | t value | Estimate | Std. Error | t value |
|----------------------|----------|------------|---------|----------|------------|---------|----------|------------|---------|
| (Intercept)           | -2.153   | 0.048      | -45.104 | -2.06    | 0.063      | -32.78  | -2.07    | 0.052      | -39.741 |
| Trial Number (log)   | -0.046   | 0.01       | -4.376  | -0.036   | 0.014      | -2.658  | -0.044   | 0.01       | -4.17   |
| Target Valence (centred) | -0.024  | 0.008      | -2.978  | -0.034   | 0.013      | -2.651  | -0.027   | 0.012      | -2.272  |
| Response (Approach + vs Avoid -) | -0.267  | 0.027      | -9.931  | -0.292   | 0.028      | -10.341 | -0.294   | 0.034      | -8.604  |
| Target Valence by Response | 0.009   | 0.01      | 0.869   | 0.011    | 0.016      | 0.676   | 0.008    | 0.015      | 0.524   |
## 6.2 Robustness Checks of Statistics on Action Dynamics Indices (Expt 2)

Log(RT) and MAD

|                      | All Participants | Excluding Consistent Avoiders and Non-Avoiders | Controlled for EqPt Interactions |
|----------------------|------------------|-----------------------------------------------|---------------------------------|
|                      | Estimate | Std. Error | t value | Estimate | Std. Error | t value | Estimate | Std. Error | t value |
| (Intercept)          | 6.998    | 0.041      | 171.084 | 7.162    | 0.034      | 210.789 | 7.046    | 0.039      | 180.953 |
| Trial Number (log)   | -0.016   | 0.005      | -3.496  | -0.007   | 0.006      | -1.124  | -0.016   | 0.005      | -3.596  |
| Target Valence (centred) | -0.038  | 0.005      | -7.244  | -0.066   | 0.007      | -8.865  | -0.021   | 0.005      | -3.885  |
| Response (Approach + vs Avoid -) | -0.064  | 0.016      | -4.009  | -0.074   | 0.015      | -4.881  | -0.008   | 0.018      | -0.478  |
| Target Valence by Response | 0.033   | 0.006      | 5.675   | 0.053    | 0.008      | 6.185   | 0.012    | 0.006      | 2.174   |

|                      | Estimate | Std. Error | t value | Estimate | Std. Error | t value | Estimate | Std. Error | t value |
| (Intercept)          | 274.891  | 14.107     | 19.486  | 261.491  | 20.094     | 13.014  | 268.267  | 13.761     | 19.494  |
| Trial Number (log)   | 3.027    | 3.381      | -0.986  | 0.612    | 4.891      | 0.125   | 2.78     | 3.377      | 0.823   |
| Target Valence (centred) | -1.695  | 1.719      | -0.986  | -5.673   | 3.357      | -1.69   | -4.106   | 1.645      | -2.496  |
| Response (Approach + vs Avoid -) | -129.27 | 10.262     | -12.597 | -114.344 | 11.491     | -9.951  | -115.241 | 10.063     | -11.452 |
| Target Valence by Response | -2.559  | 3.381      | -0.757  | 2.022    | 6.451      | 0.313   | 2.353    | 3.191      | 0.737   |
### 6.3 Robustness Checks of Statistics on Action Dynamics Indices (Expt 2)

X-Flips and Sample Entropy

|                         | All Participants | Excluding Consistent Avoiders and Non-Avoiders | Controlled for EqPt Interactions |
|-------------------------|------------------|-----------------------------------------------|----------------------------------|
|                         | Estimate | Std. Error | z value | Estimate | Std. Error | z value | Estimate | Std. Error | z value |
| (Intercept)             | 0.5      | 0.04       | 12.633  | 0.597    | 0.055      | 10.884  | 0.502    | 0.04       | 12.46   |
| Trial Number (log)      | -0.031   | 0.011      | -2.698  | -0.028   | 0.016      | -1.784  | -0.031   | 0.012      | -2.682  |
| Target Valence (centred)| -0.014   | 0.005      | -2.542  | -0.021   | 0.009      | -2.226  | -0.013   | 0.006      | -2.245  |
| Response (Approach + vs Avoid -) | -0.13    | 0.033      | -3.94   | -0.092   | 0.036      | -2.55   | -0.129   | 0.035      | -3.732  |
| Target Valence by Response | -0.009  | 0.011      | -0.818  | -0.005   | 0.02       | -0.259  | -0.01    | 0.011      | -0.859  |

|                         | Sample Entropy | Estimate | Std. Error | t value | Estimate | Std. Error | t value | Estimate | Std. Error | t value |
|-------------------------|----------------|----------|------------|---------|----------|------------|---------|----------|------------|---------|
| (Intercept)             | -2.414         | 0.054    | -44.32     | -2.416  | 0.077    | -31.443    | -2.419  | 0.055    | -44.329    |
| Trial Number (log)      | -0.033         | 0.011    | -2.996     | -0.022  | 0.015    | -1.466     | -0.033  | 0.011    | -3.013     |
| Target Valence (centred)| -0.002         | 0.005    | -0.429     | -0.004  | 0.01     | -0.407     | -0.004  | 0.006    | -0.74      |
| Response (Approach + vs Avoid -) | -0.184   | 0.034    | -5.46      | -0.177  | 0.035    | -5.04      | -0.167  | 0.035    | -4.721     |
| Target Valence by Response | -0.007  | 0.011    | -0.662     | -0.011  | 0.02     | -0.578     | -0.003  | 0.012    | -0.229     |
References (Supplementary Information)

Bardeen, J. R., Fergus, T. A., & Orcutt, H. K. (2014). The moderating role of experiential avoidance in the prospective relationship between anxiety sensitivity and anxiety. *Cognitive Therapy and Research, 38*(4), 465-471. https://doi.org/10.1007/s10608-014-9614-z

Carver, C. S., & White, T. L. (1994). Behavioral inhibition, behavioural activation, and affective responses to impending reward and punishment: The BIS/BAS Scales. *Journal of Personality and Social Psychology, 67* (2), 319-333. doi: 10.1037/0022-3514.67.2.319

Fergus, T. A. (2015). I really believe I suffer from a health problem: Examining an association between cognitive fusion and healthy anxiety. *Journal of Clinical Psychology, 71*(9), 920-934. https://doi.org/10.1002/jclp.22194

Gámez, W., Chmielewski, M., Kotov, R., Ruggero, C., Suzuki, N., & Watson, D. (2014). The brief experiential avoidance questionnaire: development and initial validation. *Psychological Assessment, 26*(1), 35. doi: 10.1037/a0034473

Heiberger, R. M. (2018). HH: Statistical Analysis and Data Display: Heiberger and Holland. R package version 3.1-35. URL https://CRAN.R-project.org/package=HH

Heiberger, R. M., & Robbins, N. B. (2014). Design of diverging stacked bar charts for Likert scales and other applications. *Journal of Statistical Software, 57*(5), 1-32. http://www.jstatsoft.org/v57/i05/

Jorm, A. F., Christensen, H., Henderson, A. S., Jacomb, P. A., Korten, A. E., & Rodgers, B. (1999). Using the BIS/BAS scales to measure behavioural inhibition and behavioural activation: Factor structure, validity and norms in a large community sample. *Personality and Individual Differences, 26*(1), 49-58. http://dx.doi.org/10.1016/S0191-8869(98)00143-3

Lewin, K. (1935). *A dynamic theory of personality*. New York, NY: McGraw-Hill.

McNaughton, N., & Corr, P. J. (2008). The neuropsychology of fear and anxiety: A foundation for reinforcement sensitivity theory. In P. J. Corr., (Ed.). *The reinforcement sensitivity theory of personality* (pp. 44-94). New York, NY, US: Cambridge University Press.

McNaughton, N., & Gray, J. A. (2000). Anxiolytic action on the behavioural inhibition system implies multiple types of arousal contribute to anxiety. Journal of affective disorders, 61(3), 161-176.

Miller, N. E. (1944). Experimental studies of conflict. In J. McV. Hunt (Ed.), *Personality and the Behavioral Disorders* (vol. 1, pp. 431-465). New York, NY: Wiley.

Poythress, N. G., Skeem, J. L., Weir, J., Lilienfeld, S. O., Douglas, K. S., Edens, J. F., & Kennealy, P. J. (2008). Psychometric properties of Carver and White’s (1994) BIS/BAS scales in a large sample of offenders. *Personality and Individual Differences, 45*(8), 732-737. doi: 10.1016/j.paid.2008.07.021

Ross, S. R., Benning, S. D., Patrick, C. J., Thompson, A., & Thurston, A. (2009). Factors of the Psychopathic Personality Inventory: Criterion-related validity and relationship to the BIS/BAS and Five-Factor Models of Personality. *Assessment, 16*(1), 71-87. https://doi.org/10.1177/1073191108322207

Tyndall, I., Waldeck, D., Pancani, L., Whelan, R., Roche, B., & Dawson, D. L. (2019). The Acceptance and Action Questionnaire-II (AAQ-II) as a measure of experiential avoidance: Concerns over discriminant validity. *Journal of Contextual Behavioral Science, 12*, 278-284. https://doi.org/10.1016/j.jcbs.2018.09.005

Vandeweghe, L., Matton, A., Beyers, W., Vervaet, M., Braet, C., & Goossens, L. (2016). Psychometric Properties of the BIS/BAS Scales and the SPSRQ in Flemish Adolescents. *Psychologica Belgica, 56*(4), 406-420. http://doi.org/10.5334/pb.298