

Supplementary Material 2A: *Local* explanation rules to understand why the model predicts “High Neurotic” individuals based on their financial transactions data

Table 4. Local explanations that show the features that (counterfactually) explain the predicted class High Neuroticism. A selection of explanations is shown for instances i with highest predicted scores s_i .

Instance i	Counterfactual Explanation for Instance i
Person a ($s_a = 0.69$) $size_{CF,a} = 5$	If you had spent <i>less frequently</i> in Computers & Electronics, Insurance and Shops, and <i>more frequently</i> in Clothing & Accessories and Restaurants → then you would not have been predicted as Neurotic
Person b ($s_b = 0.66$) $size_{CF,b} = 4$	If you had spent <i>less frequently</i> in Pets, Shops and Veterinarians, and spent <i>less money</i> on Subscription → you would not have been predicted as Neurotic
Person c ($s_c = 0.65$) $size_{CF,c} = 3$	If you had spent <i>less frequently</i> in Shops, <i>less money</i> on Internal Account Transfer and Subscription → then you would not have been predicted as Neurotic
Person d ($s_d = 0.65$) $size_{CF,d} = 2$	If you had spent <i>less frequently</i> in Shops, and <i>less money</i> on Subscription → then you would not have been predicted as Neurotic
Person e ($s_e = 0.65$) $size_{CF,e} = 4$	If you had spent <i>less frequently</i> in Food & Beverage, PayPal and Shops, and <i>less money</i> on Subscription → then you would not have been predicted as Neurotic
Person f ($s_f = 0.65$) $size_{CF,f} = 4$	If you had spent <i>less frequently</i> in Check, Department stores and Shops, and <i>more frequently</i> in Supermarkets & Groceries → then you would not have been predicted as Neurotic
Person g ($s_g = 0.64$) $size_{CF,g} = 4$	If you had spent <i>less frequently</i> in Shops and Tobacco, and <i>less money</i> on Subscription and Tobacco → then you would not have been predicted as Neurotic
Person h ($s_h = 0.64$) $size_{CF,h} = 8$	If you had spent <i>less frequently</i> in Food & Beverage, Vintage & Thrift, <i>less money</i> on Department stores, Shops, Tobacco and Vintage & Thrift, <i>more frequently</i> in Clothing & Accessories, <i>more money</i> in Arts & Entertainment, and the variability of your spending amount was <i>lower</i> → then you would not have been predicted as Neurotic

Supplementary Material 2B: *Global* explanations rules to understand why models classify individuals as High levels of Big Five Personality Traits based on their financial transactions data

Table 2. *Global explanation rules.* If-then-else rules that explain when the algorithm classifies High levels of personality traits based on financial transactions. The Default class comprises Low to Medium levels of the same trait. Note: Discount stores and Discount stores (\$), respectively, indicate the relative number of transactions in vs. the amount of money spent in a category. ‘Square Cash’ and ‘Venmo’ are mobile payment applications to transfer money to friends and family.

Trait	Explanation Rules
Neurotic	<p><i>if (Square cash(\$)</i> \leq 0.3%) <i>and (Average transaction</i> \leq \$57.08) <i>and (Clothing & Accessories</i> \leq 0.7%) \rightarrow <i>Model predicts High Neuroticism</i></p> <p><i>if (Square cash(\$)</i> $>$ 0.3%) <i>and (Subscription(\$)</i> $>$ 0.5%) <i>and (Loans & Mortgages(\$)</i> \leq 3.9%) \rightarrow <i>Model predicts High Neuroticism</i></p> <p><i>else: Model predicts Default</i></p>
Conscientious	<p><i>if (Square cash</i> $>$ 0.4%) <i>and (Beauty Products</i> $>$ 0.3%) \rightarrow <i>Model predicts High Conscientiousness</i></p> <p><i>if (Square cash</i> $>$ 0.4%) <i>and (Beauty Products</i> \leq 0.3%) <i>and (Clothing & Accessories(\$)</i> $>$ 0.8%) \rightarrow <i>Model predicts High Conscientiousness</i></p> <p><i>if (Square cash</i> \leq 0.4%) <i>and (Discount Stores</i> $>$ 0.8%) <i>and (Shops</i> $>$ 0.5%) \rightarrow <i>Model predicts High Conscientiousness</i></p> <p><i>else: Model predicts Default</i></p>
Extroverted	<p><i>if (Square cash</i> \leq 0.7%) <i>and (Clothing & Accessories (\$)</i> $>$ 0.7%) <i>and (Hotels & Motels</i> $>$ 0.1%) \rightarrow <i>Model predicts High Extraversion</i></p> <p><i>if (Square cash</i> $>$ 0.7%) <i>and (Variability transaction amount</i> \leq 0.31) \rightarrow <i>Model predicts High Extraversion</i></p> <p><i>if (Square cash</i> $>$ 0.7%) <i>and (Variability transaction amount</i> $>$ 0.31) <i>and (Service</i> $>$ 0.3%) \rightarrow <i>Model predicts High Extraversion</i></p> <p><i>else: Model predicts Default</i></p>
Agreeable	<p><i>if (Square cash</i> \leq 0.5%) <i>and (Discount Stores(\$)</i> $>$ 0.1%) <i>and (Shops</i> \leq 0.6%) \rightarrow <i>Model predicts High Agreeableness</i></p> <p><i>if (Square cash</i> $>$ 0.5%) <i>and (Discount Stores</i> $>$ 0.7%) \rightarrow <i>Model predicts High Agreeableness</i></p> <p><i>if (Square cash</i> $>$ 0.5%) <i>and (Discount Stores</i> \leq 0.7%) <i>and (ATM</i> $>$ 5.7%) \rightarrow <i>Model predicts High Agreeableness</i></p> <p><i>else: Model predicts Default</i></p>
Open	<p><i>if (Venmo(\$)</i> $>$ 0.1%) \rightarrow <i>Model predicts High Openness</i></p> <p><i>if (Venmo(\$)</i> \leq 0.1%) <i>and (Square cash(\$)</i> $>$ 0.5%) <i>and (Digital purchase</i> $>$ 2.5%) \rightarrow <i>Model predicts High Openness</i></p> <p><i>if (Venmo(\$)</i> \leq 0.1%) <i>and (Square cash(\$)</i> \leq 0.5%) <i>and (Taxi(\$)</i> $>$ 0.4%) \rightarrow <i>Model predicts High Openness</i></p> <p><i>else: Model predicts Default</i></p>