of success and failures they produced and not in their strategy adaptivity. Study 3 provides a more controlled measure of adaptivity by manipulating the success rates of OpShort and observing the participant's adaptivity to these manipulated success rates. An additional advantage of manipulating success rates is that it becomes possible to study separately individual differences in amount of adaptivity (e.g., high vs. low amounts of strategy change) and individual differences in rate of adaptivity (e.g., fast vs. slow rates of strategy change). Because global success rates are manipulated, Study 3 also measures sensitivity to success rates at the global level.

Study 3 manipulated OpShort success rates by varying the proportion of 747s and PROPs in each 10-min trial. Because 747s can only land on long runways and PROPs can always land on either runway, the proportion of 747s and PROPs drastically affect the importance of using the long runway effectively. When there are many 747s, it should be adaptive to place the DC–10s and 727s on the short runway whenever possible. By contrast, when there are few 747s, there is much less pressure to place the DC–10s and 727s on the short runway. In this situation, it should be more adaptive to place those planes on the long runway—landing on the short runway requires making more keystrokes, knowing and accessing the rules for when the short runway is legal, and checking the current wind and weather conditions. Thus, when there are many 747s, OpShort rates should be high, and when there are few 747s, OpShort rates should be low.

Another advantage of Study 3 is that it uses participants who vary more widely in their cognitive abilities than do the typical university undergraduates. This provides advantages both in terms of the greater external validity of the findings and greater power for correlational analyses. Finally, Study 3 also uses a different battery of individual ability measures. This battery has clearer information processing underpinnings than the battery used in Studies 1 and 2 and thus is more likely to provide useful information about the cognitive correlates of strategy adaptivity. For example, we may discover whether working memory is an important component of strategy adaptivity.

Finally, in Study 3, we are able to examine both macro- and microlevel strategy adaptivity, as well as the correlation between the two. Macrolevel adaptivity will be measured as the changes in OpShort to the base-rate manipulation. Microlevel adaptivity will be defined, as in Studies 1 and 2, as the difference between OpShort use after successful landings and OpShort use after unsuccessful landings.

Method

Participants. There were 148 participants, ranging in age from 18 to 31 years (M = 23.1). They were recruited from a temporary-employment agency and paid for their participation. The study was conducted at the Brooks Air Force Base TRAIN lab as part of a larger study on individual differences. There were 123 participants in Condition A and 25 participants in Condition B. Fewer participants were assigned to Condition B because the focus was on predicting individual differences, and Condition B was simply a control condition. Approximately 65% of the participants were men, 5% of participants did not have a high school diploma, and 21% had at least some college experience.

Procedure. Study 3 used a version of the KA–ATC task that was reimplemented for the IBM Windows environment. Also, in contrast to Studies 1 and 2, participants were given only nine 10-min trials. These nine trials were divided into three blocks of three trials each.

There were two between-subject conditions that manipulated the proportion of 747s (and PROPs) across blocks in different orders. In Condition A, the proportions of 747s over the three blocks were 25%, 5%, and 50%. A second condition, Condition B, with a different order was used to ensure that the results were not peculiar to one particular order, nor simply due to changes that would have occurred naturally as a function of practice with the task (i.e., independent of the manipulation). The proportions of 747s for Condition B were 25%, 50%, and 5% across the three blocks. Because the strategy adaptivity measure is defined by plane type, one plane type (DC–10s) was set at a constant high level of 40% across all three blocks to ensure sufficient numbers for each participant on at least one plane type. The frequency of PROPs was set to be 55% minus the frequency of 747s (i.e., 30%, 50%, and 5% in Condition A and 30%, 5%, and 50% in Condition B), thereby completing the manipulation of the scarcity of the long runways. The proportion of 727s was held constant at a low level of 5% across the three blocks.

Because the focus of the study was on predicting individual differences, the remaining structure of the task was held as constant as possible across blocks and participants while still maintaining the overall dynamic structure of the task.[9]

Dependent Measures. As in Studies 1 and 2, the data consisted of the keystroke information (e.g., strategy use, planes landed, and planes crashed), and scores from the ability tests. The most important dependent measure is again OpShort. Because the DC–10 was the only plane type that occurred with a constant, high frequency in all blocks, the proportion of OpShort was only calculated for DC–10s.

The individual-ability battery was a subset of the Cognitive Abilities Measurement (CAM, version 4, Kyllonen, 1993, 1994, 1995) battery. The CAM battery provides a broad range of tests that are plausibly related to adaptivity in strategy use and has been used to predict learning and performance in a large number of training environments (e.g., Shebilske, Goettl, & Regian, 1998; Shute, 1993). The reason for selecting the CAM is that it is structured around information-processing concepts (e.g., working memory, procedural learning, processing speed, etc).

Because the full CAM is quite large and requires several days to complete, only 11 CAM tests were used. These 11 tests covered the main information processing constructs—all with plausible possible connections to adaptivity. The tests included measures of fact (or associative memory) learning, procedural learning, processing speed, working memory, and inductive reasoning. For each skill type, there was one test in the verbal domain and an isomorphic test in the spatial domain (e.g., word recognition and figure recognition). The single exception was inductive reasoning, for which only spatial reasoning tests were available, and so the three available spatial tests were included, without the complementary verbal tests. Table 2 presents each of the tests that were used (see Appendix B for more detailed descriptions of the tasks).

Each of the selected measures is a plausible correlate of strategy adaptivity. Fact learning may predict OpShort adaptivity because those participants who can memorize the rules of the task more readily may be better able to increase their use of the short runway. Similarly, participants with better procedural learning ability may learn the details of the task more quickly and then been more able to increase their use of the short runway. Participants with faster processing speed may have more free time to notice changes in base-rates and then be able to react to them. Participants with greater working-memory capacity may be better able to retain base-rate information while performing the task. Moreover, participants with greater working-memory capacity may have been better able to maintain the rules

[9] This was implemented by using different scripts for weather changes that repeated every three trials.