Suppose that we are interested in learning/identifying an object $x \in \mathcal{X}$ from observations of the form $y_1(x), y_2(x), \ldots$, where each $y_i$ is a functional on $\mathcal{X}$ that belongs to a certain collection of allowable functionals denoted by $\mathcal{Y}$. The value of each functional provides information about $x$. If the $y_i$ are specified in advance of collecting information or if they are chosen randomly and independently of $x$, then the information is said to be non-adaptive. In contrast, if the choice of $y_i$ is allowed to depend on information already gathered, the values $y_1(x), \ldots, y_{i-1}(x)$, then the information is said to be adaptive. Sometimes adaptivity helps, and sometimes it doesn’t. In this talk I will discuss two types of “adaptivity gaps,” circumstances in which there can be arbitrarily large gaps between the value of adaptive information and non-adaptive information. One type of gap arises due to a mismatch or incoherence between the $\mathcal{X}$ and $\mathcal{Y}$, and another arises in noisy sparse recovery problems. Connections will also be made between statistical inference based on adaptive information, compressed sensing, and coding with feedback.