Ideas for a Quantum Optimizer

PROBLEM:
Find a local maximum of the function $f : \mathbb{R} \to \mathbb{R}$. f must be a quantum-computable function. Most "reasonable" functions are, as a quantum computer is universal.

SUGGESTED APPROACH:
Let ψ be a quantum computer consisting of two registers which can take N possible values $\{x_i\}$. Initially the computer is set to the equiprobable superposition of states $\frac{1}{\sqrt{N}}\sum_{i=1}^{N}|x_i\rangle|0\rangle$. Through a unitary operator U_f we use quantum parallelism to put the computer in the state $\frac{1}{\sqrt{N}}\sum_{i=1}^{N}|x_i\rangle|f(x_i)\rangle$. Now we use a unitary operator T which weighs the probability associated with state i so that it is proportional to $f(x_i)$, so we obtain

$$\alpha\sum_{i=1}^{N} f(x_i)|x_i\rangle|f(x_i)\rangle$$

where α is just a normalizing constant so that the total probability is 1. Now we use a unitary operator V_p (where p is an odd integer) that puts the computer in the state

$$\beta\sum_{i=1}^{N}(f(x_i))^p|x_i\rangle|f(x_i)\rangle$$

where β is another normalizing constant. Finally we observe the computer. The most probable observation is a local maximum of f, say $|x_0\rangle|f(x_0)\rangle$, with probability $|\beta f(x_i)^p|^2$. Of course, the highest p is, the sharpest the probability curve will be, so a high p ensures a high probability of getting a state that correspondes to a point very near a local maximum. **Note also that the state with highest probability is the global maximum**.

DRAWBACK:
I am still not sure whether T and V_p can be implemented with unitary quantum operators. In fact, from what I gathered from experts, it seems likely that V_p can be a unitary operator, but T cannot. Hence this approach for quantum optimization may be flawed. However, a modification could be implemented for quantum feasibility, for there we have an oracle function (i.e. plug the value into the constraints and see if they satisfy it). So we could use quantum parallelism and quantum database search.