Two states p, q of a labelled transition system $(S, \Delta, \longrightarrow)$ are *bisimilar* (notation $p \dot{\sim} q$) if there exists a *bisimulation* that relates them; that is, a relation R such that if $a \in \Delta$ is a label and $s\,R\,t$,

$$s \xrightarrow{a} s' \implies \exists t' : s'\,R\,t' \wedge t \xrightarrow{a} t';$$
$$t \xrightarrow{a} t' \implies \exists s' : s'\,R\,t' \wedge s \xrightarrow{a} s'.$$

Only one of these is necessary if one assumes R is symmetric. Since $\dot{\sim}$ is the largest bisimulation, to prove $s \dot{\sim} t$ it is enough to find a symmetric R such that $s\,R\,t$ implies

$$s \xrightarrow{a} s' \implies \exists t' : s' \dot{\sim} R \dot{\sim} t' \wedge t \xrightarrow{a} t', \tag{1}$$

where juxtaposition indicates relational composition; we say that R *progresses* to $\dot{\sim} R \dot{\sim}$ when (1) holds. This technique to prove bisimilarity is known as *bisimulation up-to* $\dot{\sim}$ and was introduced by Milner [Calculi for synchrony and asynchrony. Theoret. Comput. Sci. 25 (1983), no. 3, 267–310. MR0716132]. Sangiorgi [On the bisimulation proof method. Math. Structures Comput. Sci. 8 (1998), no. 5, 447–479. MR1652718] studied variants of the set function $R \mapsto \dot{\sim} R \dot{\sim}$. It is apparent that the bigger the value of the function, the easier the proof of bisimilarity. Among the functions which lead to proofs of bisimilarity, Sangiorgi singled out the class of *respectful* functions (preserving the combination of inclusion and progression between relations), and proved that there is a maximal such function.

This paper presents an explicit characterization of the largest respectful function $\mathcal{F}$. It uses the ordinal stratification of bisimulation $\dot{\sim} = \bigcap_\alpha \sim_\alpha$ (see [Robin Milner, Communication and Concurrency. Prentice-Hall International Series in Computer Science (1989)]), and essentially there are two cases. If $R \subseteq \dot{\sim}$, then $\mathcal{F}(R) = \dot{\sim}$. Otherwise, $\mathcal{F}(R) = \sim_\alpha$ for the largest α such that $R \subseteq \sim_\alpha$.

The authors finally compare this approach to analogous notions in the literature involving complete lattices.