Page 45 clarification

Theorem: If H_1 and H_2 are subgroups of a group G ($H_1 \leq G$ and $H_2 \leq G$) and $H_1H_2 \leq G$ then $H_1H_2 = H_2H_1$

Proof: We show that $H_2H_1 \subseteq H_1H_2$. The other direction is similar. Let $h_1 \in H_1$ and $h_2 \in H_2$. Then $h_2h_1 \in H_2H_1$. Since H_1 and H_2 are subgroups $h_1^{-1} \in H_1$ and $h_2^{-1} \in H_2$. Thus $h_1^{-1}h_2^{-1} \in H_1H_2$. But since $H_1H_2 \leq G$, the inverse of $h_1^{-1}h_2^{-1}$ is in H_1H_2. Thus $h_2h_1 \in H_1H_2$. QED