


生物策略表

類別	生物策略 (Strategy)
生物策略 STRATEGY	椋鳥組織鳥群內部的行為 (Starlings Coordinate Movements Within a Flock)
生物系統 LIVING SYSTEM	歐洲椋鳥 <i>Sturnus vulgaris</i> (European starling)
功能類別 FUNCTIONS	#透過自我組織維持群落協調 #Coordinate by Self-Organization
作用機制標題	椋鳥將注意力放在最靠近自身的七隻鳥以維持鳥群穩定 (Starlings stay together within a flock by paying attention to the movements of the seven other birds closest to it)
生物系統/作用機制 示意圖	
作用機制摘要說明 (SUMMARY OF FUNCTIONING MECHANISMS)	
<p>當你外出而在車陣中駕車行駛時，只需要將注意力放在正前方的車輛以維持在車列中。但如果你今天要在空中飛行的車陣中保持陣形呢？這正是一群椋鳥 (starling) 需要辦到的。椋鳥群幾乎每天傍晚都會在同一片天空成群繞圈，就像只是為了好玩一樣。事實上，研究人員也不是很確定為何椋鳥會進行這種協調舞蹈。椋鳥們能在數百到數千隻鳥的鳥群 (flock) 中與同伴保持著幾英寸的距離飛行，並以高速轉向，但卻從來不會相撞。牠們是怎麼辦到的呢？</p> <p>椋鳥透過將注意力放在周圍同伴的速度與方向來應付這種高難度表演。然而，牠們並不會同時專注於群體中的所有鳥。一隻椋鳥只需要關注於最靠近牠的七隻鳥之行動。少注意一隻，將會導致可靠的資訊量不足以使其保持在鳥群中最精確地飛行。多注意一隻，則會因資訊量過多而無法快速處理並作出即時抉擇 (real-time decision)。事實證明，不論鳥群的大小及密度，僅注意周圍七隻同伴是最理想的數量。</p> <p>椋鳥們以最適量的資訊來協調飛行行為，可以讓人們從中學習。我們通常都在過多資訊的狀況下做抉擇。到底多少的資訊量才是足夠呢？椋鳥提醒了我們要平衡資訊量的多少來做抉擇，並學習過濾過多的資訊。</p> <p>When you are driving in a large group of cars to some destination, you only need to pay attention to the car driving directly ahead of you to stay in the group. But what if you were trying to stay together with a whole group of cars, flying through the air together? This is what flocks of starlings must do. Starlings fly together in large groups, often every evening, circling through the same portion of sky almost as though for the fun of it. In fact, researchers are not</p>	

even sure why starlings do these coordinated dances. Starlings are able to stay within inches of other starlings, in groups of hundreds or thousands of individuals, turning at high speeds, without ever colliding. How do they do this?

Starlings are able to manage these high-performance acrobatics by paying close attention to the speed and direction of the other starlings around them. However, starlings don't pay attention to all the other birds in the flock at once. A starling just needs to pay attention to the movements of the seven other starlings closest to it. Any fewer, and there's not enough reliable information for a starling to maintain flying with precision within the flock. Any more, and there's too much information to process quickly and make real-time decisions. It turns out that seven neighbors are the ideal number, regardless of how large or dense the flock is.

The way starlings coordinate their behavior with an optimal amount of information has many lessons for people. We have to make decisions often with too much information at our fingertips. How much information is enough? Starlings remind us that there is a balance between having enough good information to make decisions, and learning to filter out the rest.

文獻引用 (REFERENCES)

「我們的分析說明，每隻椋鳥周圍的同伴數量（七隻），會在獲得鳥群飛行穩固性 (robustness) 的益處下，與耗費感知和專注力 (sensing and attention) 的代價之間取得最佳效益。」(Young et al. 2013: 4).

「一般來說，我們的實驗結果表明了當要維持整體一致 (consensus)，在網絡系統有效地處理不確定性 (uncertainty) 中，誰與誰互動會起重要作用。這也提出了可能性來了解及評估其它社會或技術網絡 (technological network) 中的不確定性。」(Young et al. 2013: 6)

「以往的成果顯示椋鳥會將注意力集中在最靠近的七隻同伴上，不過直到現在仍未瞭解為何這個數目是七。我們的論文解釋了這個謎團：當感官中存在不確定性，與六或七隻鄰近同伴互動可以在群體凝聚力 (group cohesiveness) 與個體努力 (individual effort) 之間取得平衡。」(Young et al. 2013: 2)

“Our analysis shows that the size (seven) of each starling's neighborhood optimally trades off gains from robustness with costs associated with sensing and attention...” (Young et al. 2013: 4).

“More generally, our work demonstrates the significant role of who is interacting with whom in the ability of a network to efficiently manage uncertainty when seeking to maintain consensus. This suggests possibilities for understanding and evaluating uncertainty management in other social and technological networks.” (Young et al. 2013: 6)

“Previous work has shown that starlings pay attention to their seven closest neighbors, but until now it was not understood why this number is seven. Our paper explains the mystery: when uncertainty in sensing is present, interacting with six or seven neighbors optimizes the balance between group cohesiveness and individual effort.” (Young et al. 2013: 2)

參考文獻清單與連結 (REFERENCE LIST)

Young, G.F., L. Scardovi, A. Cavagna, I. Giardina, and N. E. Leonard. Starling Flock Networks Manage Uncertainty in Consensus at Low Cost. *PLoS computational biology* 9: e1002894. (<https://doi.org/10.1371/journal.pcbi.1002894>)

延伸閱讀: Harvard 或 APA 格式
生物系統延伸資訊連結 (LEARN MORE ABOUT THE LIVING SYSTEM/S)
撰寫/翻譯/編修者與日期
李威廷翻譯 (2021/04/06); 譚國鏞編修 (2021/04/29); 林有駿編修 (2021/11/21); 陳柏宇編修 (2022/01/02)
AskNature原文連結
https://asknature.org/strategy/starlings-coordinate-movements-within-a-flock/



出處:

<https://www.allaboutbirds.org/news/how-do-starling-flocks-create-those-mesmerizing-murmurations/>