

= Dazzle camouflage =

Dazzle camouflage , also known as razzle dazzle (USA) or dazzle painting , was a family of ship camouflage used extensively in World War I , and to a lesser extent in World War II and afterwards . Credited to the British marine artist Norman Wilkinson , though with a rejected prior claim by the zoologist John Graham Kerr , it consisted of complex patterns of geometric shapes in contrasting colours , interrupting and intersecting each other .

Unlike other forms of camouflage , the intention of dazzle is not to conceal but to make it difficult to estimate a target 's range , speed , and heading . Norman Wilkinson explained in 1919 that he had intended dazzle more to mislead the enemy about a ship 's course and so to take up a poor firing position , than actually to cause the enemy to miss his shot when firing .

Dazzle was adopted by the Admiralty in Britain , and then by the United States Navy , with little evaluation . Each ship 's dazzle pattern was unique to avoid making classes of ships instantly recognisable to the enemy . The result was that a profusion of dazzle schemes was tried , and the evidence for their success was at best mixed . So many factors were involved that it was impossible to determine which were important , and whether any of the colour schemes were effective .

Dazzle attracted the notice of artists such as Picasso , who claimed that Cubists like himself had invented it . Edward Wadsworth , who supervised the camouflaging of over 2 @, @ 000 ships during the First World War , painted a series of canvases of dazzle ships after the war , based on his wartime work . Arthur Lismer similarly painted a series of dazzle ship canvases .

= = Intended purposes = =

At first glance , dazzle seems an unlikely form of camouflage , drawing attention to the ship rather than hiding it . The approach was developed after Allied navies were unable to develop effective means to hide ships in all weather conditions . The British zoologist John Graham Kerr proposed the application of camouflage to British warships in the First World War , outlining what he believed to be the applicable principle , disruptive camouflage , in a letter to Winston Churchill in 1914 explaining the goal was to confuse , not to conceal , by disrupting a ship 's outline . Kerr compared the effect to that created by the patterns on a series of land animals , the giraffe , zebra and jaguar .

Taking up the zebra example , Kerr proposed that the vertical lines of ships ' masts be disrupted with irregular white bands . Hiding these would make ships less conspicuous , and would " greatly increase the difficulty of accurate range finding " . However , in the same letter , Kerr also calls for countershading , the use of paint to obliterate self @-@ shading and thus to flatten out the appearance of solid , recognisable shapes . For example , he proposes to paint ships ' guns grey on top , grading to white below , so the guns would disappear against a grey background . Similarly , he advised painting shaded parts of the ship white , and brightly lit parts in grey , again with smooth grading between them , making shapes and structures invisible . Kerr was thus hoping to achieve both a measure of invisibility and a degree of confusion for the enemy using a rangefinder . Whether through this mixing of goals , or the Admiralty 's skepticism about " any theory based upon the analogy of animals " , the Admiralty claimed in July 1915 to have conducted " various trials " and decided to paint its ships in monotone grey , not adopting any of Kerr 's suggestions . It had made up its mind , and all Kerr 's subsequent letters achieved nothing .

The American artist Abbott Handerson Thayer had developed a theory of camouflage based on countershading and disruptive coloration , which he had published in the controversial 1909 book *Concealing @-@ Coloration in the Animal Kingdom* . Seeing the opportunity to put his theory into service , Thayer wrote to Churchill in February 1915 , proposing to camouflage submarines by countershading them like fish such as mackerel , and advocating painting ships white to make them invisible . His ideas were considered by the Admiralty , but rejected along with Kerr 's proposals as being " freak methods of painting ships ... of academic interest but not of practical advantage " . The Admiralty noted that the required camouflage would vary depending on the light , the changing colours of sea and sky , the time of day , and the angle of the sun . Thayer made repeated and desperate efforts to persuade the authorities , and in November 1915 travelled to England where he

gave demonstrations of his theory around the country . He had a warm welcome from Kerr in Glasgow , and was so enthused by this show of support that he avoided meeting the War Office , who he had been intending to win over , and instead sailed home , continuing to write ineffective letters to the British and American authorities .

The marine artist and Royal Naval Volunteer Reserve officer Norman Wilkinson , agreed with Kerr that dazzle 's aim was confusion rather than concealment , but disagreed about the type of confusion to be sown in the enemy 's mind . What Wilkinson wanted to do was to make it difficult for an enemy to estimate a ship 's type , size , speed , and heading , and thereby confuse enemy ship commanders into taking mistaken or poor firing positions . An observer would find it difficult to know exactly whether the stern or the bow was in view ; and it would be correspondingly difficult to estimate whether the observed vessel was moving towards or away from the observer 's position .

Wilkinson advocated " masses of strongly contrasted colour " to confuse the enemy about a ship 's heading . Thus , while dazzle , in some lighting conditions or at close ranges , might actually increase a ship 's visibility , the conspicuous patterns would obscure the outlines of the ship 's hull (though admittedly not the superstructure) , disguising the ship 's correct heading and making it harder to hit .

Dazzle was created in response to an extreme need , and hosted by an organisation , the Admiralty , which had already rejected an approach supported by scientific theory : Kerr 's proposal to use " parti @-@ colouring " based on the known camouflage methods of disruptive coloration and countershading . This was dropped in favour of an admittedly non @-@ scientific approach , led by the socially well @-@ connected Wilkinson . Kerr 's explanations of the principles were clear , logical , and based on years of study , while Wilkinson 's were simple and inspirational , based on an artist 's perception . The decision was likely because the Admiralty felt comfortable with Wilkinson , in sharp contrast to their awkward relationship with the stubborn and pedantic Kerr .

Wilkinson claimed not to have known of the zoological theories of camouflage of Kerr and Thayer , admitting only to having heard of the " old invisibility @-@ idea " from Roman times .

= = Possible mechanisms = =

In 1973 , the naval museum curator Robert F. Sumrall suggested a mechanism by which dazzle camouflage may have sown the kind of confusion that Wilkinson had intended for it . Coincidence rangefinders used for naval artillery had an optical mechanism , operated by a human to compute the range . The operator adjusted the mechanism until the two half @-@ images of the target lined up in a complete picture . Dazzle , Sumrall argued , was intended to make that hard , as clashing patterns looked abnormal even when the two halves were aligned , something that became more important when submarine periscopes included such rangefinders . Patterns sometimes also included a false bow wave to make it difficult for an enemy to estimate the ship 's speed .

The historian Sam Willis argued that since Wilkinson knew it was impossible to make a ship invisible with paint , the " extreme opposite " was the answer , using conspicuous shapes and violent colour contrasts to confuse enemy submarine commanders . Willis pointed out , using the HMT Olympic dazzle scheme as an example , that different mechanisms could have been at work . The contradictory patterns on the ship 's funnels could imply the ship was on a different heading . The curve on the hull below the front funnel could seem to be a false bow wave , creating a misleading impression of the ship 's speed . And the striped patterns at bow and stern could create confusion about which end of the ship was which .

That dazzle did indeed work along these lines is suggested by the testimony of a U @-@ boat captain :

It was not until she was within half a mile that I could make out she was one ship [not several] steering a course at right angles , crossing from starboard to port . The dark painted stripes on her after part made her stern appear her bow , and a broad cut of green paint amidships looks like a patch of water . The weather was bright and visibility good ; this was the best camouflage I have ever seen .

In 2011 , the scientist Nicholas E. Scott @-@ Samuel and colleagues presented evidence using

moving patterns on a computer that human perception of speed is distorted by dazzle patterns . However the speeds required are much larger than were available to First World War ships : Scott @-@ Samuel notes that the targets in the experiment would correspond to a dazzle @-@ patterned Land Rover vehicle at a range of 70 metres , travelling at 90 kilometres per hour . A confusion in aiming of the observed size , 7 % , for a rocket propelled grenade travelling 70 metres in 0 @. @ 5 seconds , would be 7 % of the distance moved by the target , or 90 centimetres , perhaps enough to save life in that situation .

= = World War I = =

In 1914 , Kerr persuaded the First Lord of the Admiralty , Winston Churchill , to adopt a form of military camouflage which he called " parti @-@ colouring " . He argued both for countershading (following the American artist Abbott Thayer) , and for disruptive coloration , both as used by animals . A general order to the British fleet issued on 10 November 1914 advocated use of Kerr 's approach . It was applied in various ways to British warships such as HMS Implacable , where officers noted approvingly that the pattern " increased difficulty of accurate range finding " . However , following Churchill 's departure from the Admiralty , the Royal Navy reverted to plain grey paint schemes , informing Kerr in July 1915 that " various trials had been undertaken and that the range of conditions of light and surroundings rendered it necessary to modify considerably any theory based upon the analogy of [the colours and patterns of] animals " .

The British Army inaugurated its Camouflage Section for land use at the end of 1916 . At sea in 1917 , heavy losses of merchant ships to Germany 's unrestricted submarine warfare campaign led to new desire for camouflage . The marine painter Norman Wilkinson promoted a system of stripes and broken lines " to distort the external shape by violent colour contrasts " and confuse the enemy about the speed and dimensions of a ship . Wilkinson , then a lieutenant commander on Royal Navy patrol duty , implemented the precursor of " dazzle " beginning with the merchantman SS Industry . Wilkinson was put in charge of a camouflage unit which used the technique on large groups of merchant ships . Over 4000 British merchant ships were painted in what came to be known as " dazzle camouflage " ; dazzle was also applied to some 400 naval vessels , starting in August 1917 .

All British patterns were different , first tested on small wooden models viewed through a periscope in a studio . Most of the model designs were painted by women from London 's Royal Academy of Arts . A foreman then scaled up their designs for the real thing . Painters , however , were not alone in the project . Creative people including sculptors , artists , and set designers designed camouflage .

Wilkinson 's Dazzle camouflage was accepted by the Admiralty , even without practical visual assessment protocols for improving performance by modifying designs and colours . The dazzle camouflage strategy was adopted by other navies . This led to more scientific studies of colour options which might enhance camouflage effectiveness .

After the war , starting on 27 October 1919 , an Admiralty committee met to determine who had priority for the invention of dazzle . Kerr was asked whether he thought Wilkinson had personally benefited from anything he Kerr had written . Kerr avoided the question , implying that he had not , and said " I make no claim to have invented the principle of parti @-@ colouring , this principle was , of course , invented by nature " . He agreed also that he had not suggested anywhere in his letters that his system would " create an illusion as to the course of the vessel painted " . In October 1920 the Admiralty told Kerr that he was not seen as responsible for dazzle painting . In 1922 Wilkinson was awarded the sum of £ 2000 for the invention .

= = Effectiveness = =

Dazzle 's effectiveness was highly uncertain at the time of the First World War , but it was nonetheless adopted both in Britain and America . In 1918 , the Admiralty analysed shipping losses , but was unable to draw clear conclusions . Dazzle ships were attacked in 1 @. @ 47 % of sailings , compared to 1 @. @ 12 % for uncamouflaged ships , suggesting increased visibility , but as

Wilkinson had argued , dazzle was not attempting to make ships hard to see . Suggestively , of the ships that were struck by torpedoes , 43 % of the dazzle ships sank , compared to 54 % of the uncamouflaged ; and similarly , 41 % of the dazzle ships were struck amidships , compared to 52 % of the uncamouflaged . These comparisons could be taken to imply that submarine commanders did have more difficulty in deciding where a ship was heading and where to aim . However , the ships painted in dazzle were larger than the uncamouflaged ships , 38 % of them being over 5000 tons compared to only 13 % of uncamouflaged ships , making comparisons unreliable .

With hindsight , too many factors (choice of colour scheme ; size and speed of ships ; tactics used) had been varied for it to be possible to determine which factors were significant or which schemes worked best . Thayer did carry out an experiment on dazzle camouflage , but it failed to show any reliable advantage over plain paintwork .

The American data were analysed by Harold Van Buskirk in 1919 . About 1256 ships were painted in dazzle between 1 March 1918 and the end of the war on 11 November that year . Among American merchantmen 2500 tons and over , 78 uncamouflaged ships were sunk , and only 18 camouflaged ships ; out of these 18 , 11 were sunk by torpedoes , 4 in collisions and 3 by mines . No US Navy ships (all camouflaged) were sunk in the period .

= = World War II = =

However effective dazzle camouflage may have been in World War I , it became less useful as rangefinders and especially aircraft became more advanced , and , by the time it was put to use again in World War II , radar further reduced its effectiveness . However , it may still have confounded enemy submarines .

In the Royal Navy , dazzle paint schemes reappeared in January 1940 . These were unofficial , and competitions were often held between ships for the best camouflage patterns . The Royal Navy 's Camouflage Department came up with a scheme devised by a young naval officer , Peter Scott , a wildlife artist , which were developed into the Western Approaches Schemes . In 1942 the Admiralty Intermediate Disruptive Pattern came into use , followed in 1944 by the Admiralty Standard Schemes .

The United States Navy implemented a camouflage painting program in World War II , and applied it to many ship classes , from patrol craft and auxiliaries to battleships and some Essex @-@ class aircraft carriers . The designs (known as Measures , each identified with a number) were not arbitrary , but were standardised in a process which involved a planning stage , then a review , and then fleet @-@ wide implementation . Not all United States Navy measures involved dazzle patterns ; some were simple or even totally unsophisticated , such as a false bow wave on traditional Haze Grey , or Deck Blue replacing grey over part or all of the ship (the latter to counter the kamikaze threat) . Dazzle measures were used until 1945 ; in February 1945 the United States Navy 's Pacific Fleet decided to repaint its ships in non @-@ dazzle measures against the kamikaze threat , while the Atlantic Fleet continued to use dazzle , ships being repainted if transferred to the Pacific .

Nazi Germany 's Kriegsmarine first used camouflage in the 1940 Norwegian campaign . A wide range of patterns were authorised , but most commonly black and white diagonal stripes were used . Most patterns were designed to hide ships in harbour or near the coast ; they were often painted over with plain grey when operating in the Atlantic .

= = Arts = =

The abstract patterns in dazzle camouflage inspired artists including Picasso . With characteristic hyperbole , he claimed credit for camouflage experiments , which seemed to him a quintessentially Cubist technique . In a conversation with Gertrude Stein shortly after he first saw a painted cannon trundling through the streets of Paris he remarked , " Yes it is we who made it , that is cubism " . In Britain , Edward Wadsworth , who supervised dazzle camouflage painting in the war , created a series of canvases after the war based on his dazzle work on ships . In Canada , Arthur Lismer used dazzle ships in some of his wartime compositions . In America , Burnell Poole painted canvases of

United States Navy ships in dazzle camouflage at sea . The historian of camouflage Peter Forbes comments that the ships had a Modernist look , their designs succeeding as avant @-@ garde or Vorticist art .

In 2007 , the art of camouflage , including the evolution of dazzle , was featured as the theme for a show at the Imperial War Museum . In 2009 , the Fleet Library at the Rhode Island School of Design exhibited its rediscovered collection of lithographic printed plans for the camouflage of American World War I merchant ships , in an exhibition titled " Bedazzled " .

In 2014 , the Centenary Art Commission backed three dazzle camouflage installations in Britain : Carlos Cruz @-@ Diez covered the pilot ship Edmund Gardner in Liverpool 's Canning Dock with bright multi @-@ coloured dazzle artwork , as part of the city 's 2014 Liverpool Biennial art festival ; and Tobias Rehberger painted HMS President , anchored since 1922 at Blackfriars Bridge in London , to commemorate the use of dazzle , a century on . Peter Blake was commissioned to design exterior paintwork for Snowdrop , a Mersey Ferry , which he called " Everybody Razzle Dazzle " , combining his trademark motifs (stars , targets etc .) with First World War dazzle designs .

= = Other uses = =

Patterns reminiscent of dazzle camouflage are sometimes used to mask test cars during trials . During the 2015 Formula 1 testing period , the Red Bull RB11 car was painted in a scheme intended to confound rival teams ' ability to analyse its aerodynamics . The designer Adam Harvey has similarly proposed a form of camouflage reminiscent of dazzle for personal camouflage from face @-@ detection technology . It attempts to block detection by facial recognition technologies such as DeepFace " by creating an ' anti @-@ face ' " . It uses occlusion , covering certain facial features ; transformation , altering the shape or colour of parts of the face ; and a combination of the two . Since 2009 , the Sea Shepherd Conservation Society has used dazzle patterns on its fleet .

Some similarities can be drawn in the modern usage of " camos " (short for camouflages) on production @-@ intent cars that are not yet released but have to be tested on public roads . This kind of pattern prevents discerning the design or style even if photographs of the yet @-@ to @-@ be @-@ released car are taken .