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National Geographic

Code	**adi-vid-01057**
Title	National Geographic
Subtitle	The Invisible World
Description	...
Subject	Performance Analysis
Duration	00:06:17
URL	https://arielweb.com/videos/play/adi-vid-01057
Date	2003-10-21 19:11:02
Label	Approved
Privacy	Public

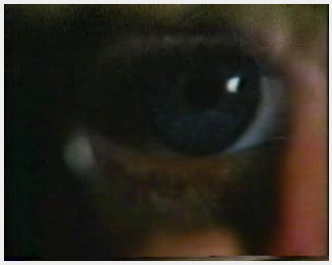
Synopsis

The human eye, despite its sensitivity and accuracy, has limitations. However, the advent of cameras and other visual instruments has expanded our vision and knowledge. The birth of photography in 1839 by Louis Daguerre was a revolutionary step, capturing images so detailed they seemed almost real. As photography evolved, it revealed things otherwise invisible to the naked eye.

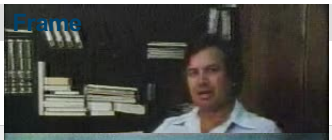
Edward Muybridge, in the 1870s, invented a way to record movements too quick to be seen, leading to the creation of the first motion pictures. Today, high-speed cameras and slow-motion films are used to analyze athletic performance. Dr. Gideon Ariel uses slow-motion film and computer analysis to study the dynamics of athletes' movements, providing coaches with objective, reliable information on body movement. This technology has helped athletes like Olympic discus thrower, Mack Wilkins, improve their performance and set new world records.

Model Id: gpt-4-0613
Created on: 2023-09-19 01:18:42
Processing time: 00:00:14.8890000
Total tokens: 1268

Audio transcription

Frame	#	Time	Spoken text
	0.	00:00:00	*Though remarkably sensitive and accurate, the human eye is an extremely limited device,*
	1.	00:00:16	*a surprisingly narrow window on our world.*
	2.	00:00:23	*Today, as never before, cameras and other instruments that see are radically expanding*
	3.	00:00:36	*the limits of our vision and knowledge, and altering forever our image of the world.*
	4.	00:00:43	*Join us now on a visual journey beyond the limits of the naked eye on a voyage into the*
	5.	00:00:49	*invisible world.*
	6.	00:01:13	*I'm E.G. Marshall. In the winter of 1839, the public of Paris was astounded by a revolutionary*
	7.	00:01:39	*new invention. With metal plates made sensitive to light, and a simple box-shaped camera,*
	8.	00:01:45	*a painter named Louis Daguerre had created a collection of images so detailed and accurate*
	9.	00:01:50	*they seemed at first sight almost real. Photography had been born, and immediately it was hailed as*
	10.	00:01:57	*the miracle of its time. The earliest cameras took pictures of familiar things that the eye*

Frame	#	Time	Spoken text
	11.	00:02:02	could readily see. People and landscapes were favorite subjects. As photography grew more
	12.	00:02:08	sophisticated, the camera revealed an endless potential for ever greater miracles, for it could
	13.	00:02:14	be made to see things that were otherwise invisible. Through the specialized eyes of
	14.	00:02:36	cameras come new dimensions of seeing. Fleeting movement hidden by time, details shrouded by
	15.	00:02:48	distance and size, are revealed as vivid images which our eyes alone could never discern. But even
	16.	00:03:01	up close, our eyes can barely resolve objects that are one three hundredths of an inch in diameter.
	17.	00:03:06	With a microscope that filters the direction of incoming light, the composition of the physical
	18.	00:03:12	world can be vividly explored. Recorded on film at actual speed, we can witness the otherwise
	19.	00:03:19	invisible process known as crystallization. In a world of motion, there is infinite details
	20.	00:03:49	too fast for the unaided eye. In the 1870s, an ingenious photographer, Edward Muybridge, invented
	21.	00:04:00	a way to record movements normally too quick to be seen. A wager about the stride of a running horse
	22.	00:04:09	brought Muybridge to the stock form of a wealthy Californian. With a battery of 24 cameras that
	23.	00:04:18	were activated by threads stretched across a track, Muybridge captured aspects of motion that
	24.	00:04:23	had never been witnessed before. Muybridge's patron had bet that all four legs of a running
	25.	00:04:32	horse were sometimes simultaneously off the ground. Stop action photography proved him to be right.
	26.	00:04:49	By projecting his photographs in rapid succession, the first motion pictures were born. The movement
	27.	00:05:00	of people as well as animals became for Muybridge a passionate subject of study.
	28.	00:05:04	Much more than just a technical curiosity, Muybridge's pioneering work was the first
	29.	00:05:17	photographic analysis of the dynamics of physical motion. Today, modern high-speed cameras can record
	30.	00:05:42	rapid motion with a clarity that Edward Muybridge could only have dreamed of. Slow motion film is
	31.	00:05:48	now a commonplace tool in analyzing athletic performance. For Dr. Gideon Ariel, a physical
	32.	00:05:59	education expert and a former discus thrower on the Israeli Olympic team, slow motion film is just
	33.	00:06:05	the first step in the scientific coaching of athletes. Coaches used to think that by looking
	34.	00:06:14	on an athlete, they could tell what the athlete does right and what he does wrong. Later on,
	35.	00:06:21	they found out it's very complicated to start taking slow motion pictures. But we're finding
	36.	00:06:27	out and coaches finding out that even looking on a slow motion film, you cannot tell what is right
	37.	00:06:33	and what is wrong. The reason is that in any movement, it's not what we see with our eyes
	38.	00:06:39	that make the difference, but there are derivatives of what the eyes see, which is displacement,
	39.	00:06:46	velocities, accelerations, forces. We cannot see acceleration. We cannot see velocity. It might
	40.	00:06:53	appear fast, it might appear slow, but the relationship of one segment to the other in
	41.	00:06:57	the body, we cannot see with our eyes. Dr. Ariel has turned to the computer for aid in the analysis
	42.	00:07:04	of movement. Slow motion film of an athlete is projected frame by frame onto a recording screen.
	43.	00:07:11	Each touch of a sonic pen transmits into the computer memory the dynamically changing

Frame	#	Time	Spoken text
	44.	**00:07:23**	*positions of the athlete's joints and limbs. Human movement is governed by the same laws*
	45.	**00:07:36**	*of motion that apply to the entire physical world and from the visual information contained*
	46.	**00:07:42**	*in the film, the computer can rapidly calculate the interrelationship of force, acceleration,*
	47.	**00:07:48**	*and velocity in the athlete's movements.*
	48.	**00:07:55**	*Computer-created images combined with a mass of numerical data*
	49.	**00:07:59**	*can pinpoint where athletic technique is hindering performance.*
	50.	**00:08:07**	*So what coaches in the past thought they can see with the eyes, we're finding out you cannot do.*
	51.	**00:08:12**	*You have to quantify it. With the advent of computers, we can provide the coaches with much*
	52.	**00:08:17**	*more objective, reliable information on how the body move. Dr. Ariel's computer analysis of*
	53.	**00:08:28**	*Olympic discus thrower, Mack Wilkins, revealed that useful energy which would affect his throw*
	54.	**00:08:34**	*was being wasted on ground friction. Additional force was being spent by not rigidly planting*
	55.	**00:08:42**	*his forward leg at the moment of the throw. Based on this analysis, Wilkins altered his*
	56.	**00:08:54**	*throwing technique.*
	57.	**00:09:15**	*Several months later in international competition, he threw the discus over 13 feet farther than he*
	58.	**00:09:21**	*ever had before and set a new world record.*

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Video filename: **adi-vid-01057-national-geographic-768kbps.mp4**