Sue Nelson
Hello, I'm Sue Nelson and welcome to the Create the Future podcast, brought to you by the Queen Elizabeth Prize for Engineering. Celebrating engineering visionaries and inspiring creative minds.
[Music]
In the history of motion picture technology, few people have had a more profound effect on cinematography than today's guest, the Oscar and Emmy winning Garrett Brown. Garrett invented an ingenious camera rig called the Steadicam, a stabilising system for cameras that allows smooth, wobble free tracking shots. It was first used in 1975 and since then it has been used in films such as Rocky, Highlander, and Casino, the rope bridge scene in Indiana Jones and the Temple of Doom, and shooting the forest background so that whizzed around the speeders in Star Wars Return of the Jedi, and almost 50 years later, the Steadicam is still going strong. And if that's not enough of an achievement, Garrett is currently CEO of Exokinetics, which is trying to replace walkers and wheelchairs with something much more clever. Well, Garrett, we'll get onto that a little later on in the podcast, but it wasn't originally called the Steadicam was it?

Garrett Brown
No, you've clearly done your homework Sue, and that's, that's correct. I thought the Steadicam was a plasticky sort of word and being a fan of 20,000 Leagues Under the Sea as a kid I wanted something named after me, an apparatus, so I wanted to call it the Brown stabiliser and they only barely prevented me from wanting it to be called the Brown apparatus. Wiser heads prevailed and I'm quite used to the word Steadicam, it has become a noun and a verb and adverb.

Sue Nelson
And you were working as a cameraman at the time. What made you realise that there were shots that you wanted to do and you couldn't do them. What was the issue?

Garrett Brown
Well, being a essentially self-taught filmmaker 3000 miles from Hollywood. In fact, someone who learned his trade in the Philadelphia free library reading all the exquisitely out of date film books. I thought that I needed a studio and a dolly. A dolly is a big, heavy wheeled object that runs on rails outdoors or on good floor indoors. And that was the only way to make smooth shots in that era, a dolly, a crane, a camera car, that's it. We have an incredible variety of tools nowadays. And it's hard to remember that if you attempted handheld shooting back then, it was gloriously free, but it was very shaky. And I hated the way it looked. Except that my 800-pound dolly with my 12-pound wind up spring wind camera was so absurdly pin headed that even I, thought that something better had to be possible. And, you know, I went for it, I went for something that would disconnect the camera from a handheld running, walking, stair climbing, gloriously free human being.

Sue Nelson
So describe for us what it looks like.

Garrett Brown
The original patent cited four things and it was one of those wonderful patents that's a combination of things. missing any one of those things, it simply doesn't work. And the four things if you can visualise are... large objects are more inert than small objects. If you can expand the camera by taking things that you might need anyway, you know, a battery, for example, and mounting it on a structure below the camera, then there becomes a place where that structure can be balanced, that's the centre that it would balance on. And if you put a gimbal there, which is a lovely old marine object, in my experience that stabilised lamps on ships, rings within rings, so that whatever's inside is not influenced by whatever is happening outside. So we have a stable inert long object, we have a gimbal at the middle of it, except that your hands would be very tortured to try and

float that around all day. So I needed some way to unload my hands so that I had more delicacy of touch. Because if you're holding up that object, you're gripping it so hard that whatever you do gets through to it, you know, and gripping the gimbal even you would wear yourself out. So, picture an arm, kind of a spring loaded arm with forearm and an upper arm and an elbow and a shoulder. And that spring is adjusted to float the thing in front of you very smoothly so that if you're running up and down, it just stays in place. And finally, you of course, need a vest of some sort to hang the arm on so that the weight is on your body, which is much stronger than your arm. And tada, the last thing you need is a way to see through the viewfinder because if you have your eye on it, then you're reconnected to the camera. So, in my original prototype, the only thing around was a very expensive six-foot fibre optic viewfinder of the sort that a mad proctologist might use to peer into someone. And that worked. I could see through the lens, it was effortless to float it, it was isolated by the gimbal. And it was inert. and damned if that combination didn't allow you to run flat out and the thing just glided along.

Sue Nelson
And you made a demo tape, I saw it was called “30 Impossible Shots”. Give me an example of what you know, for at the time was considered an impossible shot.

Garrett Brown
A very good question, Sue. And the answer is almost any shot that travels outdoors that doesn't show if you're looking forward that you've got rails, any shot that went up steps or a step even. Any shot over rough ground. Even any shot indoors on pretty good floor because a floor needs to be sensationally good before a dolly can deliver a smooth shot. And the delightful thing about this invention was, I could show what it did without giving any clue to how it was done. And so when we had the functioning prototype, and I had a 35 millimetre camera on it, initially we did it in 16 millimetre and several versions were long and heavy and impossibly complicated. In fact, we used to joke if somebody asked “how does it work?”, I would say, well, it's 70 feet long and you can't smoke near it. But the one that worked was relatively light, it was using my old Rommel era Africa Korps 35mm German handheld camera, but mounted on this thing it was unearthly smooth. So the shots that are impossible in our reel included walking around somebody's swimming pool as they dived in and following them and then being on the other side of it as they lurched up and actually walking under their slide. Which of course, you know, and no dolly could do, or running across fields. I even jumped off a three-foot ledge with this thing chasing my then girlfriend now wife, Ellen. And finally, Ellen ran down and backup the Philadelphia Art Museum steps, which were then unremarkable. And that reel is what got me a deal with a camera manufacturer. And we were pretty tapped out I had spent all my dough on Brown stabiliser. And we carried this reel of shots to LA. And several camera companies were interested and we made a deal with one called Cinema Product. And they immediately duplicated that film and sent it around the world because the owner of the company had relationships, you know, selling equipment to most of the studios in the world and to many of the filmmakers, and in fact, had supplied Stanley Kubrick with his super wide aperture lenses for Barry Lyndon. So among people that received this demo was Stanley Kubrick. And Kubrick set us back in astonishing telex, which was my first indication that this thing was alright, it was really going to go.

Sue Nelson
He was really going to go early adopter them wasn't he, of it?

Garrett Brown
He was. He was among the bold very few early adopters. I think the eighth movie I made was The Shining. And right away we were trotting it over there and showing Stanley what it can do. In fact, his producer and brother-in-law, Jan Harlan had seen it at Ed's factory and wrote a wonderful letter to Stanley about the so-called mystery stabiliser and Kubrick sent us a Telex which has been widely circulated and you know, saying

wonderful things “it should revolutionise the way films are made” and this and this. And “oh by the way, if you want to protect it, there's 14 frames of a shadow on the ground that show this and that about it” and we were horrified. We went into the screening room and he was right. A very Kubrick in reaction. And so we cut out those 14 frames.

Sue Nelson
Very wise advice and very generous of him as well.

Garrett Brown
Yes, and he said “is there a minimum height at which it can be used?” and we were contemplating of a manoeuvre where you flip it upside down so the cameras at the bottom of it. And therefore you have two height ranges in the ‘normal mode’ from about the waist to over the head. And in so called ‘low mode’, which we basically did for Stanley.

Sue Nelson
And was this low mode then the one that was used to follow the little boy in the hotel in the pedal car as he's going through the corridors?

Garrett Brown
Exactly.

Sue Nelson
It's funny, such a simple thing that you normally associate with, you know, children and playing and joy, but actually following that boy for it became really creepy and foreboding didn’t it? It really added to the atmosphere of a horror film?

Garrett Brown
It did and we've puzzled over why all of those shots and particularly those of Danny on his “big wheel”, why were they so eerie and so supremely interesting? And the thing about those shots is, one they're eerily smooth. And number two, they are very, almost Palladianly, centred on the set, which is not the normal compositional tools that you use when you're shooting. A bit odd and arbitrary to just be aiming straight down the middle of these sets with a lens more or less level fore and aft. And the result of that is those shots almost feel like the hotel's point of view, they have an unearthly quality as if he's being observed by some incredibly powerful entity, you know, so part of that appeal was a by-product of the smoothness and his choice for that angle.

Sue Nelson
Yeah, a wonderful melding then of the technology and your invention and the creative direction. Creativity from both sides. Is there a shot that you did that you're still really proud of?

Garrett Brown
Well, there were many, you know, traditional films of all sorts that I was really pleased with, and it's hard not to be pleased Sue when you know, when you're contributing something unique. I had the good luck for most of my stuff to be pioneering in one way or another. I can choose one I have the most affection for it. Oddly enough, it was a live filming of the Opera La Traviata in Paris in 2000. And it was shot film style on four film sets live, with a crew rushing from one to the other. And my favourite was the last act as Violetta dies against the window and Notre Dame was ringing midnight, lit up over Torroio across the river. On the Ile Saint-Louis apartment, I shot the entire last act as one 23 minute take and was in a state of almost exultation at the end of it as we all were, like, it just get those chills you mentioned every time I think about it.

Sue Nelson
That’s great. I will talk about another few films that you've worked on. But I just wanted to know actually, how long did it take you to actually design and build and sort of test out you know, until you knew you had a working prototype to make that demo film?

Garrett Brown
I regret to tell you that I'm not one of those eureka leap out of the bath fellows you know, I am a plotter, I'm very persistent. But I peer into the midst I make experiments. I am good at identifying something missing. And I'm good at making a list of every blessed thing that I want whatever it is to do. But I'm, you know, a plotter in terms of getting it done, the Steadicam started in a plumbing supply place in the mountains of Pennsylvania for $8 they made me a T-bar of pipe. I stuck a video camera on the front, carried the recorder and a couple of plumbers weights top and bottom in the back. And if you slide your hand along that pole till it’s in balance, you've got an amazingly stable object. Dreadful by my present very high standards, but a better than anything ever seen in its day. And I made videos from that. And then it annoyed me that if I tilted it up the lens rose, so I then turned into a parallelogram. I went into, notoriously, a motel for a week and isolated myself and just did something that I think happens perhaps rarely these days, I gave myself over to just thinking about it, and drawing and literally 18 hours a day, no television, meals in the room, drawings, models things and tried to break it down and analyse what worked and what didn't and what could be preserved and so on. And in the end of it I was a little disturbed that the lens would not go continuously from floor to ceiling because I ditched that big parallelogram. But I've learned since that, you know, those range of lens heights from waist to over the head or waist to knees in ‘low mode’, 95% of shots fall into that category. And if you need to get lower, sit on a box and have somebody push you along on wheels or, you know, whatever. In other words, there's a way to get the shots where you need. And I found somebody to build that version, including the arm, I conned a gorgeous fibre optic viewfinder out of American Optical, from Zigman, the man that invented Todd-AO with Michael Todd, the widescreen format. Lovely man who's still my friend. And then we launched in 1974, upon the “Impossible Shots” demo, just as I was about out of dough, and then swept off to LA, and bingo sold it.

Sue Nelson
Gosh. That's how the best inventions take place through refinement and a sort of, awareness of the practicalities of what is needed and why they're needed.

Garrett Brown
I think you're right, at the time I was dismayed that it was still sucking time and money, of course. My little business making commercials and incidentally, all the early films for Sesame Street, paid the bills. And my wife, Ellen who was my producer, and editor and all sorts of other things, kept a tally of the money we spent without ever murmuring about it under a file called “the pole” in order to confound would be infringers. And you know, it edged out to $50,000 of those dollars.

Sue Nelson
Wow, it paid off hasn’t it.

Garrett Brown
Yeah, so then when I sold it, I marched home on the plane in tears, because of how bizarre it all was, with a check for $50,000. And the boat that I had been trying to buy for years I could suddenly buy.

Sue Nelson

Gosh that’s brilliant. When you were talking about The Shining and how that Steadicam shot, put the hotel, it felt as if the hotel was centred, whereas that doesn't normally happen. When you were using it in Martin Scorsese's film, Raging Bull, how different was it in terms of technique, using it for something that you always think of the actors,

Garrett Brown
I was a decent, in fact, a good operator, the physical act and the artistic act of manipulating a camera and framing and so on, I was good at going in. And of course, had lots of practice with these prototypes, translating that skill into literally a smooth moving camera thing. But in terms of shots that work for the dramatic purposes, I was I was pretty good at that. And, you know, the shots for Scorsese, were not stylistically constrained, let's say as they were for Kubrick. They were, they were film production shots to execute the production of a scene with all the, you know, the parameters that go into that, you know, leading actors around and the wonderful coordination of a moving camera with a moving actor, that suggests strongly that you move with the actor and with the same psychic energy and when they stop, you stop and when they start, you start with the same energy and so on. And you change it up, you know, that you don't just do the same boring thing for the whole scene that you allow a choreography between yourself and the actor if the background will permit that kind of freedom and, and on and on and on. So I was able to shoot impressively. And what it amounted to was a magic carpet for, you know, Marty's lens to get it places that a conventional dolly and dolly grip and operator can't do, you know, I couldn't move the lens in these wonderful French curves that would be impossible to duplicate on wheels or crane arms, but that felt right to the viewer.

Sue Nelson
Similarly with Rocky as well?

Garrett Brown
Likewise, however, interestingly enough, I had a wonderful time on Rocky because it was a stupidly low budget film, deliberately to punish Stallone for his hubris and insisting on starring in it they cut the budget down to nothing. But the stuff we delivered was so stunning that they re-upped the production in Los Angeles and put a little more money into it and shifted production out of Philadelphia once they decided this had some promise. However, when I got to Raging Bull, I made some great shots bringing De Niro into the ring and so on. But as soon as I started shooting in the ring, I was released because that they thought it looked too much like Rocky. And they wanted a different style for that, which was a shock to me. But I have subsequently worked for Scorsese, including actually one of my favourite shots and all of them which is in a film called Casino, taking a guy into the counting room and back out again. So, I rehabilitated myself with Scorsese. I also shot Bringing Out the Dead, a very interesting film that he did.

Sue Nelson
Your inventive mind has been applied to not just the Steadicam either, with quite a few other camera related devices. Can you just pick out a few for me?

Garrett Brown
I did one called the SkyCam which flies on wires. It's likewise, a gimbal, an inert object flying on wires, except that in the place of the operator's hands they are just little motors moving it around.

Sue Nelson
Is that sort of camera you see flying above tennis courts sometimes?

Garrett Brown

Lately, yes. And football games in the US and you know increasingly, what we call soccer games around the world and lots of other things. It's a mainstay of American football. And that came about because of a conversation with a former football player, turned actor in a little series called Little House on the Prairie, here. And Michael Landon, the star and director of those things loved to study cameras, and we loved to play with it together. So Merlin Olsen, the star and I were sitting around in the endless waiting between shots and talking about football coverage, which was extremely boring at the time. Lenses way up in the stands with, you know, super telephoto lenses, but very disorienting in terms of where are you in the field and so on. And he said, “it’d be great to have a helicopter little helicopter flying over the field”. And he was absolutely right. Except I said, “Merlin, you know, you would be at risk of decapitating some very expensive persons if you tried to fly a helicopter”. Not to mention the noise and so on. But it did set me thinking and, you know, once you chase it, there's only really one way to do it. A gimbaled object with wires that go up to pulleys at the four corners of these spaces and down to motors, and the brand new then portable computers telling the motors which one to let out which to take up, you know, if all four take up, it rises. If the two on the right take up and the two on the left let out, it just traverses the field, you know. The computer can translate joystick commands into an infinite variety of moves. So that was a very difficult thing to do. And that took some years to finally get done and also get accepted in sports.

Sue Nelson
And how does the SkyCam differ from the Flycam, which is another one of your inventions?

Garrett Brown
Yes, so FlyCam is a point-to-point object that races along a single wire, it's rail, and it stabilised. And some of these others, and I'm sorry there are so many “Cams”, but I started to be asked by networks, “could I do something that would go underwater on the lane line being more or less invisible and give the underwater shot”. But of course, they'd already spent all the dough on a failed, in this case, Japanese attempt using compressed air, because everybody was nervous about electricity, doing anything have anything to do with something under the water. And the compressed air one burned up several $100,000 and kept releasing gouts of bubbles, you know, so that wasn't a success. So by the time I get in, there was no time, no dough, and so on. So we just did something really simple. And it's still a mainstay of the biggest swimming events in the world.

Sue Nelson
How about DiveCam?

Garrett Brown
That was another one, I was asked, “could you drop a camera with the divers and continue underwater?”. And once you once you have an assignment like that, it is kind of fun and not particularly mysterious to boil that down into what it could possibly be, and the most other things it could not be. It needed to drop by gravity just like the divers, it needed to be hidden in a tube with a glass port so that it wouldn't be distracting. And the tube needed to continue down onto the water, an air filled tube so this thing could pass the water surface and see how the divers pulled out of it underwater. And, you know, once you accept the idea that you're going to haul it up by hand, let it go as it turns out when the divers pelvis starts to drop. It's very confusing when you're watching a dive in the pike position. There's so many limbs flying around what actually constitutes dropping, you know, but if you watch the pelvis and let it go when the pelvis begins to drop, it falls at the same rate of the diver, including underwater. So I, you know, I have turned to on some specific challenges like that in the image making business. But in fact, you know, they're all based on providing a stable image which is what we humans have been used to since we first learn to walk. The human body has an astounding stabilising connection between your inner ear and the muscles of your eye. I only recently learned the name for it. It's the vestibulo-ocular reflex. And if you wherever you may be if you look across a room and violently tilt your head up and

down and keep your eyes on one place in the room. I hope you're doing this Sue, while I'm talking. And now do the same thing left and right, but keep your eyes on one place, it's astonishingly stable. And if you tilt your head sideways, you do not have the illusion that the room is tilting. The brain is processing all of this, it's eliminating the up and down motion by moving your eyeballs, it's eliminating the left and right. And therefore we, from birth, effectively have a SteadiCam in our heads. If you follow me, that's why evolution designed that thing. Because if it looked like handheld when you were running, you would be immediately caught by a predator and devoured. So my gizmo is the first thing that came along it can provide a native human sort of point of view, while you're moving around on your own legs.

Sue Nelson
Is there any specific shot today that you feel, “you know what I wish we had a camera that could do X, but I haven't invented it yet, or it's still something I would like to crack”?

Garrett Brown
I think my camera ambitions have been fulfilled. I joke about, cruelly in one case joke about having a MoleCam. A device that burrows onto the ground listening for the athletes and when it thinks it's promising it pops up on the field and can look around with that ground level shot. And we made a comical animated version of it, which seemed to me so absurd that no one would believe it. But I've actually had poor employees of producers from countries around the world chasing me to try and book the MoleCam because their bosses said “find this guy and find them, get me the MoleCam we want for such and such”. And I've had to tell these poor guys and girls that the MoleCam was a joke. Listen, when you think about what drones can do now and what they will do. And all these varieties of you know, gyro-stabilised, little cameras. Drones are astonishingly facile. And will be more so. They can fly through a keyhole almost, you know and fly anywhere and they're dead stable. So it's complicated. I can't say that my early self understood all of this. I think I might have had an inkling but I've given it a lot of thought. And I lucked out, I was on the right track with the SteadiCam in terms of a humanistic and human compatible point of view, as compared to handheld. I'm really bored with a handheld look and people keep applying it, you know saying “okay, this should be handheld, it's a fight scene”, let's say. And there is that jerky, violent quality to handheld. But, in fact, it's nothing like a human would see in the middle of a fight.

Sue Nelson
Like you said with that little experiment. Our brain keeps things steady. By the way, have you ever used a permanent magnet within any of your inventions?

Garrett Brown
I just actually weirdly enough used magnets for the first time, and I love magnets, by the way, Apple makes great use of them for clinging cases to things and so on. I just used magnets for the first time to tame the seat belts on this elevating walker chair, so called, which is named the Zeen after the Draisine, an early bicycle. And we just put a magnet at the bitter ends of the two sides of the seat belts so that in between use they cling to the side of the armrest, always ready to be used. Because the one of the important aspects of this thing is that, you know, if you're prone to falls and things like that it keeps the centre of you in the centre of it. So that is a combination of the saddle that rises up and down a very civilised version of a seatbelt.

Sue Nelson
And this is part of your Exokinetics?

Garrett Brown
Yeah, a product from that company.

Sue Nelson
That's really interesting to hear of a different use like that for permanent magnets purely because this year's winner of the Queen Elizabeth Prize for Engineering, that's the winning invention.

Garrett Brown
As a kid oddly enough, I did dream about things you know, I have a, you know, kind of innate understanding of Newtonian physics, but nothing really complicated or electronics or quantum mechanics or any of it. But, as many kiddo boffin types do, I dabbled with perpetual motion just to the extent of thinking that why couldn't magnets and so called MuMetal, which isolates from magnetism or shields magnetism, why couldn't that be arranged to make something using the power of the magnet run perpetually? Which I'm pretty convinced now is probably impossible, but I did think about magnets.

Sue Nelson
The sort of things you've done, I would say, never say never when it when it comes to that. So let's end then on Exokinetics. What are you working on now?

Garrett Brown
Well, this product is on the market and that's an absorbing thing. The website is Gozeen . com. If you're curious about that thing, we may even change the name of the company, just because Zeen itself is an Israeli clothes manufacturer. But that has been my occupation for a couple of years, four years actually. And it is actually quite a lovely thing. It is, in effect, a chair, a comfortable chair, that gets up and goes. It does the lifting to get you up to barstool mode, let's say, which is a very sociable altitude, but you're comfortably seated. And in between it's a great way to get around because it's got four casters and quite a nice caster invention that makes four wheeled casters behave when you're going forward. And you can therefore spin it in place, it's open in the front so you can cook and clean and put your shoes on and do earthly things. You can be sociable, leaning against it or sitting on it at the drop of a hat. You can walk prevented from falling, but most delightfully you can coast if you lean back on the saddle and are held by the belt and there's a couple of handlebars that pop out, you can just coast along like they used to coast on the Draisine just with your feet skipping along the ground. And on flat ground you can really cover a lot of territory.

Sue Nelson
So like a human SteadiCam?

Garrett Brown
Yes in effect you're sort of stabilised I wanted to call it, the Brown ambulator.

Sue Nelson
Garrett Brown, thank you so much for joining me on the Create the Future podcast. I mean, our guests are always amazing, but all the inventions you've done as a as a sort of cinema goer, thank you. It's marvellous to hear you talk about your inventions.

Garrett Brown
Thank you Sue, it was fun.

Sue Nelson
Find out more about the Queen Elizabeth Prize for Engineering by following @qeprize on Twitter and Instagram or visit qeprize.org. Thanks for listening and join me again next time.